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ABSTRACT

Working from the premise that for any given periodical title there is some frequency of use at which it becomes cheaper for a library to acquire the publication than to borrow it, this report presents a mathematical model for estimating the costs of options associated with acquiring periodicals. Cost elements included in the model are initial cost, annual recurring cost, internal use cost, internal borrowing cost, external borrowing cost, storage cost, disposition (weeding) cost, and subscription cost. The report shows how, given these variables, the model can determine the crossover or breakeven point at which the cost of borrowing equals the cost of owning. Appendices include a detailed derivation of the cost model and the associated computer program written in APL, details concerning the cost surveys, and results generated from the model helpful in answering questions concerning the acquisition, maintenance, and discarding of back issues of periodicals. (JD)

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COSTS OF OWNING, BORROWING, AND DISPOSING OF PERIODICAL PUBLICATIONS

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ABSTRACT

A library or information center satisfies user needs for a periodical by either maintaining the publication in its own collection or borrowing it from other libraries. At low levels of use, borrowing is the less costly alternative, while at high levels of use owning is the less costly alternative. At an intermediate level of use, called the crossover point, owning and borrowing are equally costly. Crossover points have been estimated as a function of subscription and borrowing costs using cost data from three research libraries and usage characteristics representing collections in either science and technology or humanities and social sciences. These results were estimated by means of a cost model written in APL which can be made available upon request.

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CHAPTER 1

INTRODUCTION

Background

User needs for periodicals are satisfied in one of two ways by a library or information center: the library either maintains the publication in its own collection, or it borrows requested items from other libraries. Both cost money. To maintain a periodical in its own collection, the library must select, order, process, store and make the publication available. For a requested item in a publication not in its own collection, there is the staff cost to locate and borrow the item; and in many cases, a photocopy charge. The cost to satisfy a request by borrowing is roughly the same each time, whereas the average cost per use of a publication acquired for the library collection is a function of how frequently it is used. Consequently, for any given periodical title there is some frequency of use at which it becomes cheaper for a library to acquire the publication than to borrow it to satisfy patron demand.

Many libraries are now facing reduced budgets; the rapidly increasing costs of periodical subscriptions, the new copyright law and the proposed national periodicals system[1] have focused special attention upon periodical acquisitions and potentials for controlling or decreasing expenditures in this area.

To realize these potentials, it is highly desirable to be able to estimate the costs of options associated with acquiring periodicals. This report uses a mathematical model for estimating such costs to address the following question: Should a library own (i.e., subscribe to) or should it borrow, when needed, a specific periodical?

An earlier version of this model was developed by Westat, Inc. in 1968, under contract with The Center for Research Libraries; it computed the cost of owning versus borrowing to satisfy demand for serial publications.[2, 3, 4] Input to the 1968 model consisted of average cost data drawn from a survey of four university libraries, and use characteristics derived from interlibrary loan data collected at several large lending libraries. The model developed in this report uses cost figures drawn from a 1977 survey of two university libraries and one special library, and use characteristics derived from internal use data collected at two university libraries.

Overview of Model

Both the 1968 and the current models were designed to determine the frequency of use above which owning a periodical is cheaper than borrowing it. At this frequency, which is called the crossover point or breakeven point, the cost of borrowing equals the cost of owning. At frequencies of use below this point, borrowing is less costly than owning. At frequencies of use above the crossover point, owning is less costly than borrowing.

Figure 1 illustrates this phenomenon. It stems from the fact that there are two kinds of costs:

1. Costs that are independent of the frequency of use.
2. Costs that are proportional to the frequency of use.

As we shall see, owning a periodical involves both kinds of costs, while borrowing a periodical involves only the second kind of costs.

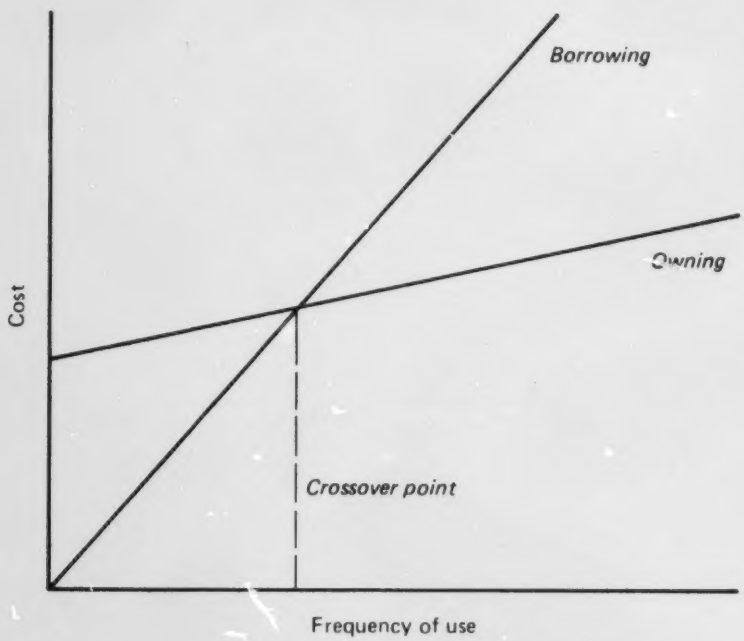

FIG. 1: COSTS AS A FUNCTION OF THE FREQUENCY OF USE FOR OWNING AND BORROWING

It should be noted that selecting the option that minimizes the cost for a single library does not necessarily coincide with minimizing the costs for society as a whole. Certain social costs are incurred when a library depends upon borrowing of a title for patrons, namely:

1. Loss of browsing capacity which may result in loss of use for marginal titles that a user will not request through interlibrary loan.

2. Delays to users when materials must be borrowed from another library.

3. Additional costs incurred by lending institutions that are not charged to the borrowing library.

From the social point of view, monies saved by libraries will have other effects. These might include increased subscription prices, loss of profits for commercial journal publishers, discontinuance of some periodicals, and pressure for some form of subsidy, to either libraries or journal publishers. Although the model was never intended for a cost-benefit analysis of owning versus borrowing from a social point of view, a general observation can be made. The crossover points, in terms of level of use, would be lower for a social optimum than those calculated by the model from a single library's perspective.

The costs of owning and borrowing were computed for various frequencies of use as follows. The various costs incurred in each year of a specified planning period (25 years) were adjusted for inflation, discounted to the present value,[5] and then summed over all years of the period. The inflation rate and the discount rate were assumed to be 4 and 6 percent, respectively. Cost elements included in the model are:

1. Initial cost - The cost of ordering and cataloging a new title. This cost is applicable only if the periodical is ordered within the planning period.

2. Annual recurring cost - This includes annual review and selection, renewal of subscription, (exclusive of actual subscription cost), check-in, claiming, shelving, preparation of serials list, training, direct supervision of tasks, binding preparation, and bindery. The annual recurring cost does not include the actual subscription cost, and is independent of the number of years of back issues held or the average annual use of the periodical.

3. Internal use cost - Circulation cost, labor for reshelving of materials used, and for shelf maintenance, and in-library cost not recovered through fees for lending materials to other libraries through interlibrary loan, are included in this category. The total internal use cost is based on the average annual use of all issues of the title, and is dependent upon the number of volumes of back issues held.

4. Internal borrowing cost - The average unit cost within the library for borrowing an item through interlibrary loan. It includes staff time for verifying, locating, and forwarding a request for the desired item, and postage charges. Total cost reflects the number of items borrowed annually.

5. External borrowing cost - This is the charge made by the lending library for interlibrary loans or photocopies, and is again dependent upon the number of items borrowed annually.

6. Storage cost - This cost applies only where storage space is critical and weeding options are considered. It is assumed to be proportional to the number of volumes of back issues held.

7. Disposition (weeding) cost - The cost of removing materials from library shelves, changing records, and discarding. It is assumed to be proportional to the number of volumes being removed.

8. Subscription cost - The annual subscription price for the title.

Study Objectives

The 1968 Westat study, using the earlier version of the cost model, found that a serial title with an annual subscription price of $20 (the average price found in the study) had a crossover point of six uses per year. This result resembles the guidelines associated with the new copyright law.

The new copyright law (Public Law 94-553, October 19, 1976) comes into general operation on January 1, 1978. Section 108 of the new act permits libraries open to the public and to specialized researchers to make single copies of periodical articles for patrons or to secure single copies of articles through interlibrary loan arrangements which

> "do not have, as their purpose or effect, that the library or archives receiving such copies or phonorecords for distribution does so in such aggregate quantities as to substitute for a subscription to or purchase of such work."

This "aggregate quantity" was defined in the so-called "CONTU Guidelines"* incorporated in the Conference Committee Report on the bill which became the new copyright act (H. Report N. 94-1733, September 29, 1976, pages 72-74), as being six or more copies of any article published in the last five years from a periodical, or six or more copies of small portions of other copyrighted material without limitation of time. If the library subscribes to (or places an order for) the periodical or owns the copyrighted work, the five copy limitation does not apply.

To evaluate the impact of these guidelines on libraries, CONTU desired to review the current economics of owning versus borrowing periodical materials, by updating the 1968 cost inputs to the model. A contract was given to the Public Research Institute to conduct the study.[6] While the primary purpose of the study was to investigate the frequency of use above which it becomes cheaper for a library to own a periodical rather than to borrow the item when needed, objectives also included:

1. Comparing the limit of 5 copies in the CONTU Guidelines with model results.

*CONTU is an acronym for the National Commission on New Technological Uses of Copyrighted Works.

2. Comparing the 1968 results to results based on current costs.

3. Applying the model to answer questions concerning the acquisition, maintenance, and discarding of back issues.

4. Updating and making the model available for use by librarians.

The remainder of this report consists of two chapters: Estimating Model Inputs and Crossover Points for Owning Versus Borrowing Decisions.

The appendices include:

- a detailed derivation of the cost model, and the associated computer program written in APL
- details concerning the cost surveys
- results generated by the model helpful in answering questions concerning the acquisition, maintenance, and discarding of back issues.

CHAPTER 2

ESTIMATING MODEL INPUTS

Cost Inputs

In developing cost inputs for the model, an attempt was made to utilize, where possible, only those costs which would be altered by the addition or subtraction of a periodical title.[7] Costs of tasks related to periodicals which clearly are not affected by the number of subscriptions held in the library, such as overhead, general administration and supervision, and reference service have been excluded. Consequently, the summation of costs included in the model over a one year period does not result in the total annual cost for handling periodicals. While it would be desirable to have estimates of the marginal costs for handling one additional title, available data only allowed computation of average costs for the various tasks. For example, certain labor charges which make up the largest part of costs tend to increase in steps as a function of the number of titles owned; the addition or subtraction of a few titles does not affect the labor costs.

Data for the first four cost elements (initial cost, annual recurring cost, internal use cost, and internal borrowing cost) were collected from three main libraries and two branch libraries. See appendix B for details on the collection of cost data and appendix C for a step-by-step guide for the collection of these costs. For purposes of analysis, data were used from the three main libraries as follows:

A. The main library of a large university. The 1,000,000 volumes and almost 7,000 current journal subscriptions were primarily in the humanities, social sciences, and life sciences.

B. A smaller academic main library, with about 350,000 volumes, including 46,000 bound periodical volumes, and 2,615 current journal titles. The collection is similar to that of library A, with holdings in humanities, social sciences, and life sciences. A small percentage of basic physical science materials are also included.

C. A large special library (science and technology) with holdings in physics, chemistry, mathematics, and technology. About four-fifths of the 125,000 volume collection is bound journals; the library carries slightly over 2,200 current journal titles, including a substantial level of gifts and exchange.

The estimated unit costs of the four cost elements for the three libraries are shown in table 1. These estimated costs were used as inputs for model runs as discussed in the next chapter.

TABLE 1

UNIT COSTS FOR THREE LIBRARIES

Cost Element	Library A	Library B	Library C
Initial cost (per title added)			
New paid subscription	$70.65	$11.54	$53.53
New free subscription	44.61	—	37.91
Annual recurring cost (per current title)	24.45	9.31	25.94
Internal use cost (per use)	0.36	0.58	0.48
Internal borrowing cost (per item borrowed)	7.02	5.09	9.48

Other cost elements included in the model have been applied uniformly to each of the three libraries. (See appendix B for derivation of costs.) They are:

1. External borrowing costs - Borrowing costs have been calculated with lending library charges of $0, $3, and $8.

2. Storage cost - Storage per annual volume (i.e., an annual volume is defined to include all issues for a calendar year, regardless of labeling or binding) is calculated at $0.50; for microfilm, storage costs are put at $0.05 per reel or $0.016 per annual volume. Storage costs are entered only is cases where weeding is being considered due to space constraints, since in other cases it is not considered a marginal cost.

3. Disposition (weeding cost) - Weeding costs are included at $0.65 per annual volume discarded.

4. Subscription cost - Five subscription costs are considered: $0, $20, $40, $80, and $120. An average 1977 subscription cost for academic libraries is estimated at about $40 across all subject areas, although actual subscription prices ranged from $0 to $3,000 in three libraries.[8] Subscription prices for scientific publications are much higher on the average.[9]

Total costs were computed for a planning period of 25 years, with an annual discount rate of 6 percent and an annual inflation rate of 4 percent.

Use Inputs

The model requires two kinds of inputs to specify use characteristics. First, the cumulative percentage of total use of a periodical volume as a function of its age is needed. This distribution specifies the annual decay in the frequency of use of an individual periodical issue as a function of its age. In other words, the cumulative distribution provides the "shape" of the decay in use over time, but does not specify the magnitude of use. Secondly, a normalized annual frequency of use is required to specify the magnitude or intensity of use.

Ideally the inputs on use would be derived from the same library as the cost inputs, but this is not essential. Libraries with similar collections should experience roughly the same percentage of total use for a title (as a function of its age) over comparable time periods.

Very few libraries have investigated the actual use of periodicals owned. Consequently, few data are available to estimate use levels for models such as the one used here. The use portion of the model developed in 1968 relied upon interlibrary loan data collected at several large lending libraries, i.e., National Library of Medicine, National Agricultural Library, John Crerar Library, and the National Lending Library for Science and Technology (now the British Library Lending Division). This data showed that, on the average, the use of each annual volume of a periodical title declined by about seven percent each year. Data were not available at that time on actual internal use of journals in libraries.

Internal use data recently became available from two university libraries. At the University of Pittsburgh, data have been published for three branch libraries: a physical science library, an engineering library, and a life sciences library.[10] Use of a general collection in the humanities, social, and life sciences, has been tabulated in a second university. This second library was one that provided cost data also, Library B mentioned in a previous section. As expected, the use of individual periodical issues in these libraries was more heavily concentrated in the years immediately following their publication than the use through interlibrary loan in 1968. This recent analysis showed that the previous assumption of usage following a geometric distribution of decay as a function of age, while perhaps applicable to interlibrary loan, is not realistic for internal library use. Consequently, the model was reprogrammed to accept any empirical distribution of use as a function of age, as well as the geometric distribution.

The use data available from Library B seemed appropriate also for Library A since both collections are similar as far as subject coverage. An average distribution of use based on data from the physical science library and the engineering library of the University of Pittsburgh was used for Library C. The two cumulative distributions are given in table 2.

TABLE 2

CUMULATIVE PERCENTAGE OF TOTAL USE FOR AN INDIVIDUAL PERIODICAL ISSUE AS A FUNCTION OF AGE

Age, Years After Issue	Cumulative Percentage of Total Use	
	Science & Technology	Social & Life Sciences
1	53	43
2	65	56
3	71	65.4
4	75	73
5	78	79
6	80	82
7	82	83.8
8	83.5	85.6
9	85	86.9
10	86.5	88.1
11	88	89.2
12	89.5	90.2
13	91	91.1
14	92.5	91.9
15	94	92.6
16	95	93.2
17	96	93.7
18	97	94.1
19	98	94.4
20	98.2	94.6
21	98.3	94.9
22	98.4	95.2
23	98.5	95.5
24	98.6	95.8
25	98.7	96.1

In addition to the cumulative distribution of use of a periodical volume as a function of its age, another input is required to specify the frequency of use of the title. The frequency of use in any particular time frame is related to the number of issues of the specific title which are available, either in the library or through interlibrary loan. Consequently, a use level of 10 items per year in the first year of publication of a new title represents a higher level of use than does an annual use of 10 items of an old title with, for example, 30 years of back issues.

To limit the number of cases required, annual use has been normalized in the model to reflect the use of a periodical title in its eleventh year of publication; in other words, a title with 10 years of back issues. Thus, in applying the model to a specific title it is necessary to adjust the estimated annual use upward or downward, depending upon the number of years the title has been published, to obtain the normalized annual use. This is done by multiplying the estimated annual use by an adjustment factor determined for the number of years of back issues for the title. Adjustment factors are calculated by dividing the cumulative use percentage for the tenth year (of the appropriate use curve) by the cumulative use percentage of the publication year being considered. Table 3 lists the adjustment factors for the science and technology and the general collection use distributions used here.

TABLE 3

ADJUSTMENT FACTORS FOR NORMALIZING ANNUAL USE TO THE USE FOR A PERIODICAL WITH TEN YEARS OF BACK ISSUES

	Adjustment Factor	
Years of back issues	Science and technology	Humanities, social and life sciences
1	1.63	2.06
2	1.33	1.57
3	1.22	1.35
4	1.15	1.21
5	1.11	1.11
6	1.08	1.08
7	1.05	1.05
8	1.04	1.03
9	1.02	1.01
10	1.00	1.00
12	.97	.98
15	.91	.95
17	.90	.94
20	.88	.93
25	.88	.92
30	.87	.91

Several values of annual use are input for each model run, as cost is calculated as a function of frequency of use. Typical values of the use ranged from 0 to 30.

Future annual use of a title may grow or decline depending on a number of factors such as:

1. Number of back issues available.
2. Size of user population.
3. Amount of available literature.

The model accounts only for the expected growth in annual use attributable to the availability of more back issues as the title ages. Estimating the effect of the user population size is more difficult due to the lack of necessary data. While the overall number of potential users may appear to be increasing in a specific field or discipline, the net effect of this growth or a particular title may be offset by the growth in the number of titles in the field. The rapid growth in highly specialized fields of science along with the corresponding increase in the number of new titles is a good example of this phenomenon. Although the 1968 model included a parameter to reflect the change in user population size, it was removed in the current model because adequate data were not available to estimate it.

CHAPTER 3

CROSSOVER POINTS FOR OWNING VERSUS BORROWING DECISIONS

The model was used to investigate the basic question: should a library own (i.e., subscribe) or should it borrow, when needed, a specific periodical title? This question contains two cases:

Case 1. Library does not presently subscribe to the periodical title.
Case 2. Library does subscribe to the periodical title.

A decision with regard to Case 1 results in a library borrowing to meet patron demand for the title, or placing a subscription for the title. In Case 2 the decision outcomes are for the library to continue its subscription, or terminate the subscription and borrow to fulfill requests for items in future issues of the title. The decision to terminate a current subscription also raises the question of whether the library should continue to store the back files of the terminated title. The model was used also to examine a number of weeding options; these results are contained in appendix D.

An example of the model results for one library will be demonstrated first. Next, crossover points for the two cases will be examined for the three libraries. The chapter will conclude with some comments on how these results compare to the 1968 results and to the CONTU Guidelines.

Example Calculation

In order to acquaint the reader with the type of results available from the model and their application, consider the situation where a librarian wishes to decide on whether to continue a current subscription to a periodical title that has been published for 20 years. Available data indicated that the title (including all 20 years of back files assumed owned by the library) was used a total of 5 times during the last year. Further, assume that the current subscription price is $40 per year.

The cost inputs shown earlier in table 1 for Library A were used to calculate the crossover points shown in figure 2. Crossover points are shown for three interlibrary loan costs (external borrowing costs) -- $8, $3, and free. Most libraries charge for photocopies of periodicals supplied to other requesting libraries. The fees charged vary from library to library, but the $3 external borrowing cost is probably more typical of photocopy charges. The crossover point for a $3 external borrowing cost is seen as about 7-1/2 normalized uses per year. It is important to remember that the model operates in terms of normalized use per year. The actual number of uses in the previous year for the particular title being considered was assumed to be 5. On the expectation that the use over the next year will be the same, the actual use of 5 must be adjusted to

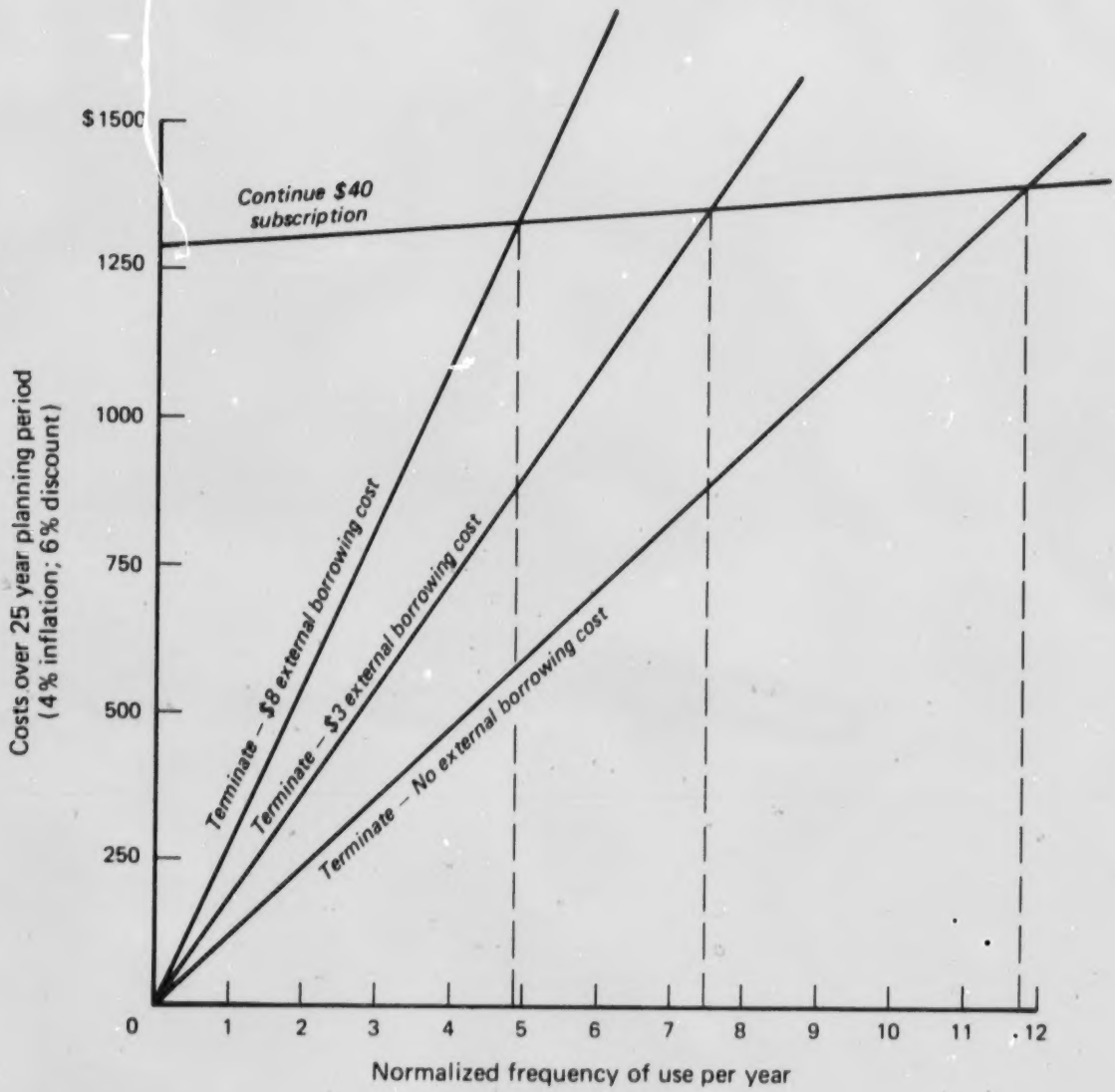

FIG. 2: COST CURVES FOR DECISION TO CONTINUE OR DISCONTINUE A SUBSCRIPTION FOR LIBRARY A

correspond to a 10-year old title (which the model assumes) rather than its real age of 20 years. Going back to table 3 in chapter 2, the adjustment factor is .93 found under the heading of humanities, social and life sciences. Library A has that kind of collection. The adjustment factor is multiplied by the actual or observed demand (.93 x 5 = 4.65), which, in this case, does not really change that much. The adjusted expected use is less than the normalized use shown in figure 2 at the crossover point (7-1/2); therefore, the decision should be to terminate the subscription for the title. Up to 7-1/2 normalized uses per year, it is cheaper for the library to borrow, at $3 each time, in order to meet patron needs for the title. It becomes cheaper to subscribe and maintain the title if it is used greater than 7-1/2 times (in terms of normalized uses) per year, according to the model.

If library A had to pay $8 for each interlibrary loan, the crossover point would move down to just less than 5 normalized uses per year. The decision should be to retain the subscription in this case. Likewise, the library would be ahead to borrow in order to fill requests for a $40 title up to about 12 normalized uses per year if there are no external borrowing costs (free interlibrary loan). All of the calculations in this example assumed that back issues would be retained for titles terminated.

This example has shown the concept of the crossover point in decisions regarding the continuation or termination of a periodical subscription. The next section will expand upon the kind of investigation for the case in which a library does not presently subscribe to a title.

Decisions on Titles Not Presently Owned

Results were produced by the model for each of the three sets of costs inputs representing libraries A, B, and C. Libraries A and B are both university libraries with their journal collections primarily in the humanities, social sciences and life sciences. Library C is a large special library (science and technology) with collection strengths in physics, chemistry, mathematics, and technology. The purpose of using three libraries was to provide some comparisons based on differences in costs and collections.

Rather than showing a series of figures displaying the crossover points as in figure 2, we have chosen to first present in graphic form the crossover points as a function of annual subscription prices for each of three libraries. Figure 3 allows one to determine the crossover points for the decision on whether to borrow or subscribe to meet user needs for a newly-published title (no back files) with a single external borrowing cost of $3. In examining figure 3, remember that the crosspoint point is that normalized frequency of use per year at which the cost of subscribing equals the cost of borrowing. If the library's normalized annual use is less than the crossover point, it should borrow; if greater, it should subscribe.

Although the input costs for the three libraries vary considerably (table 1), the crossover points for the lower priced titles are not that different. The crossover points

are between about 5.7 and 7.4 for a $40 subscription price. For all practical purposes, the three crossover points could be considered the same for this subscription rate. The closeness of library A and B is rather surprising given what appears to be large difference in the input costs. Library A's costs are all much higher except for the internal use cost. Consequently, the most significant finding from figure 3 is that for lower priced periodicals the crossover point is not very sensitive to internal handling costs of libraries.

Crossover points for $0 and $8 external borrowing costs, as well as $3, are given in table 4. The reader is reminded that the crossover points in this discussion and table 4 are in terms of normalized frequencies of use. Even though the decision being considered concerns a new title with no back files, the model computes crossover points for a 10-year old title. In order to compare observed or expected use in a library, the observed frequency of use must be multiplied by the appropriate adjustment factor from table 3. The appropriate adjustment factor for libraries A and B is 2.06, and for library C, it is 1.63.

TABLE 4

CROSSOVER POINTS FOR DECISIONS ON BORROWING OR SUBSCRIBING TO A 10-YEAR OLD TITLE NOT PRESENTLY OWNED FOR LIBRARIES A, B, AND C

Subscription cost	Crossover point (normalized frequency of use)								
	EBC[1]=$0			EBC=$3			EBC=$8		
	Library			Library			Library		
	A	B	C	A	B	C	A	B	C
Free	4	3	3	3	1	2	2	1	2
$20	8	7	6	5	4	4	4	3	3
$40	11	12	8	7	7	6	5	4	4
$80	17	21	12	12	12	9	8	8	7
$120	23	30	17	16	18	13	11	11	9

[1] EBC = External Borrowing Cost

The sensitivity of the crossover point to changes in the external borrowing cost can be seen in figure 4 for Library A. In the case of a $40 subscription price, the crossover point varies from about 11 for no external borrowing cost to about 5 for an $8 interlibrary loan charge. The crossover point for the $8 borrowing cost is observed to be approximately half of that for the $0 borrowing cost. This would be expected -- as the external borrowing cost goes up the library can afford to purchase a subscription at a lower frequency of use.

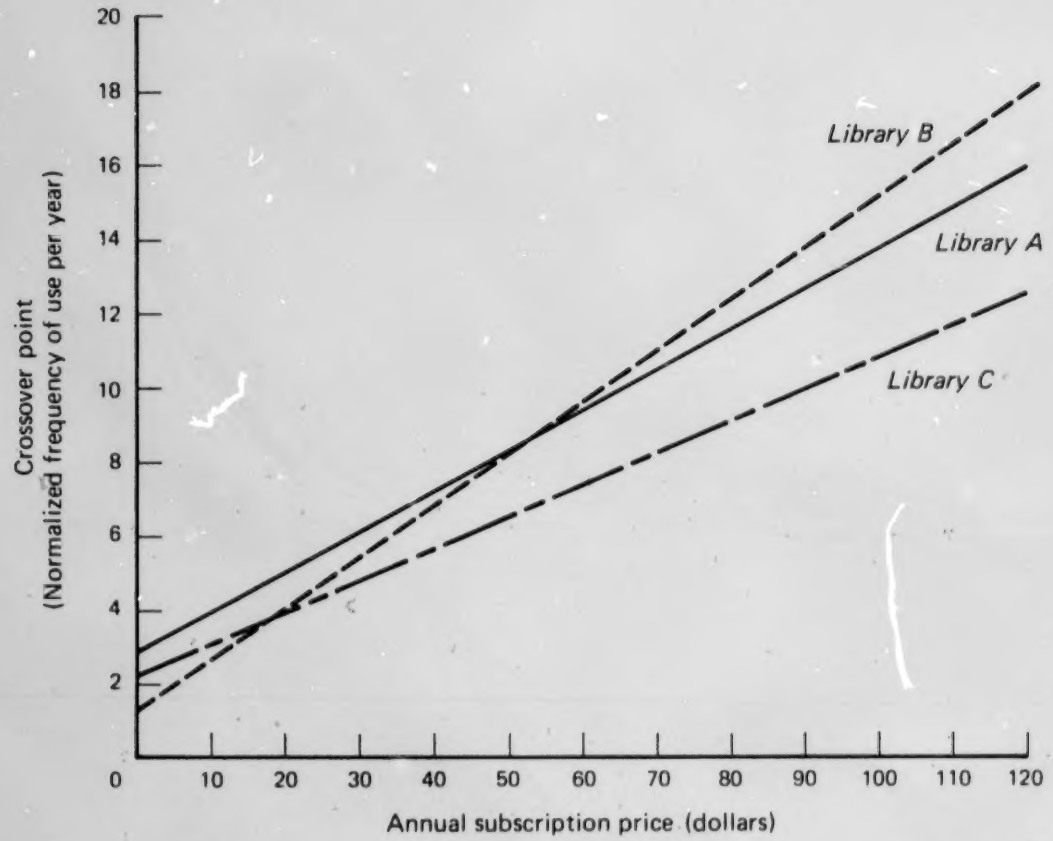

FIG. 3: CROSSOVER POINTS AS A FUNCTION OF SUBSCRIPTION PRICES FOR DECISION TO SUBSCRIBE OR BORROW A TITLE NOT PRESENTLY OWNED – EXTERNAL BORROWING COST OF $3

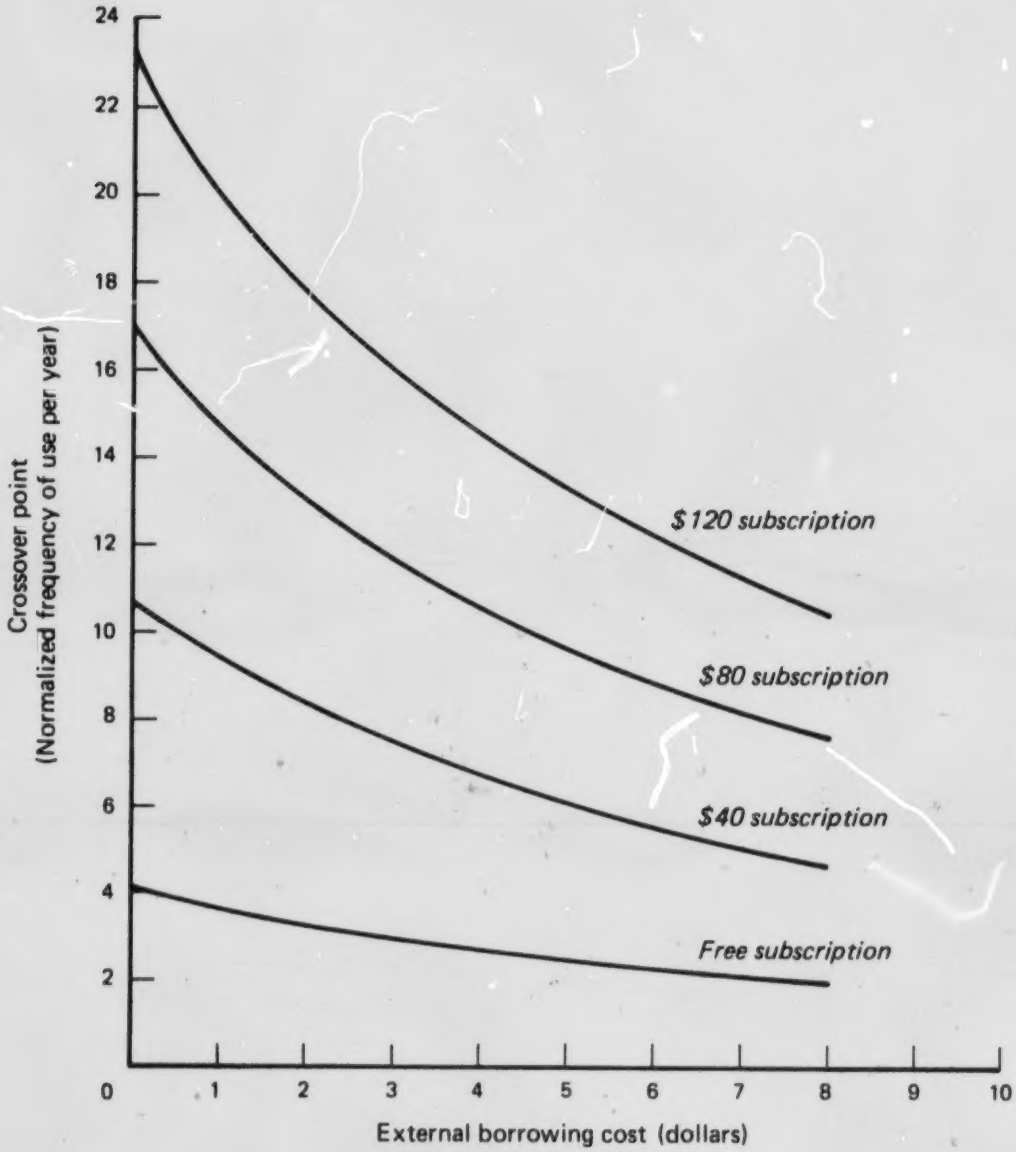

FIG. 4: CROSSOVER POINTS FOR LIBRARY A FOR DECISIONS TO SUBSCRIBE OR BORROW A TITLE NOT PRESENTLY OWNED AS A FUNCTION OF EXTERNAL BORROWING COST

One other situation can exist under the case where the library does not presently subscribe to the periodical title under consideration. The above discussion centered on a newly-published title. The decision may concern an older title that the library has not subscribed to before.

A library considering a new subscription to a title which has been published for some time frequently utilizes user demand, as demonstrated by interlibrary loan requests, as the basis for such subscription decision. In determining the use level at which subscribing to an older title becomes less expensive than borrowing items from it, table 4 applies to titles of any age by the use of the appropriate adjustment factors from table 3. The crossover points in table 4 apply directly to the decision on whether to borrow or subscribe to a 10-year old title not presently owned by the libraries.

It has been assumed in this instance, that back issues are not to be acquired but will be borrowed as needed. Should back issues be acquired, initial costs should be increased by the cost of acquisition of these issues, including the cost of purchase. Borrowing costs will be eliminated as part of owning costs, since all requests will be filled from the collection. A comparison of added acquisition costs and deleted borrowing costs will show whether the breakeven use level will increase or decrease as a result of this option.

Decisions on Current Subscriptions

The second case investigated involves decisions on periodical titles that a library currently subscribes to. In light of present budget crises facing many libraries, this second case addresses a more serious problem area at this time. The primary decision is to decide whether to continue a current subscription or to terminate it and borrow to meet user requests for it.

As we saw in the previous section, the model calculates cost in terms of normalized use or the expected use in the 11th year, i.e., a 10-year old title. Decisions on titles of any age may be made from figures and tables based on normalized use by adjusting the observed use according to factors given in table 3.

Figure 5 presents the crossover points for all three libraries as a function of subscription price. The crossover points in the figure were computed on the basis of a $3 external borrowing cost. For free and $8 external borrowing costs, the crossover points can be seen in table 5.

There is little difference in the crossover points shown in table 5 and table 4. The case on decisions for titles not presently owned by a library (table 4) includes the one-time initial cost of adding a new title, but the influence of this cost is small over a 25-year planning period. Otherwise, the costs for the two kinds of decisions -- borrow or subscribe and continue to subscribe or borrow -- are the same. The sensitivity of the crossover points to changes in the external borrowing cost are also essentially the same (figure 4).

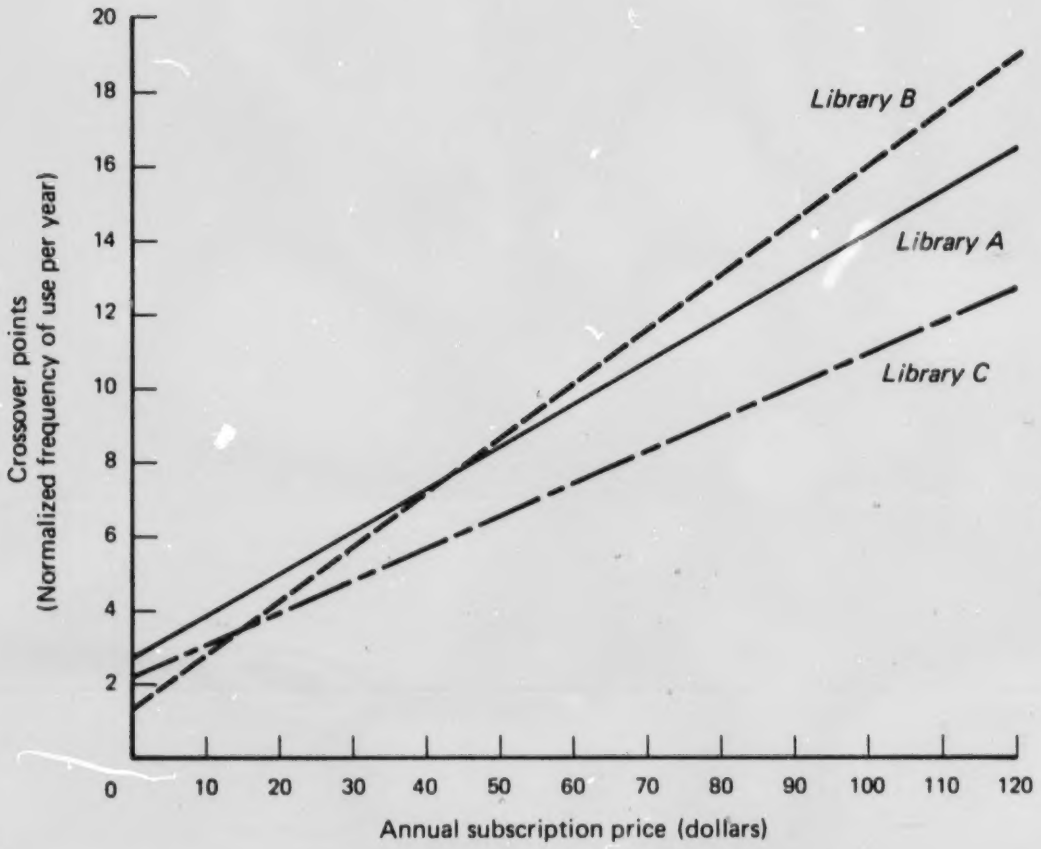

FIG. 5: CROSSOVER POINTS AS A FUNCTION OF SUBSCRIPTION PRICE FOR DECISION TO CONTINUE OR TERMINATE A CURRENT SUBSCRIPTION – EXTERNAL BORROWING COST OF $3

TABLE 5

CROSSOVER POINTS FOR DECISIONS ON BORROWING OR MAINTAINING A CURRENT SUBSCRIPTION FOR LIBRARIES A, B, AND C -- RETAIN 10 YEARS OF BACK ISSUES

Subscription cost	Crossover point (normalized frequency of use)								
	EBC[1]=$0			EBC=$3			EBC=$8		
	Library			Library			Library		
	A	B	C	A	B	C	A	B	C
Free	4	2	3	3	2	2	2	1	1
$20	7	7	6	5	5	4	3	3	3
$40	11	12	8	7	7	6	5	5	4
$80	18	22	13	12	13	9	8	8	7
$120	24	32	17	17	19	13	11	11	9

[1]EBC = External Borrowing Cost

Where use levels are below the crossover points and the decision is made to terminate the subscription, a second decision as to disposition of the ten years of back issues is required. Table 6 indicates the levels of use below which it remains cheaper to borrow, when termination includes discarding of back issues.

TABLE 6

CROSSOVER POINTS FOR DECISIONS ON BORROWING OR MAINTAINING A CURRENT SUBSCRIPTION FOR LIBRARIES A, B, AND C -- REMOVE AND DISCARD 10 YEARS OF BACK ISSUES

Subscription cost	Crossover point (normalized frequency of use)								
	EBC[1]=$0			EBC=$3			EBC=$8		
	Library			Library			Library		
	A	B	C	A	B	C	A	B	C
Free	3	2	3	2	1	2	1	1	1
$20	6	6	5	4	4	3	3	2	2
$40	9	10	7	6	6	5	4	4	3
$80	15	19	11	10	11	8	7	7	6
$120	20	27	15	14	16	11	9	10	8

[1]EBC = External Borrowing Cost

Storage of back issues has been assumed to be free. This is a valid assumption only for libraries with adequate space. Storage costs are not included in any of the calculations presented in this chapter. Appendix D contains results on weeding options under the assumption of space constraints and storage costs. With no storage costs taken into account, the cost differences between terminating a subscription and retaining back issues and terminating and discarding back issues are attributable to the lower internal use cost as compared to the external borrowing cost for back issues. Consequently, the retention of back issues offers the cheaper option as reflected in the higher crossover points in table 5 (as compared to those in table 6). The higher cost of borrowing to meet requests for items in the discarded back issues moves the crossover points down, making owning favorable at lower frequencies of use.

Comparison With 1968 Results

The validity of comparisons between current results and findings of the 1968 study is somewhat questionable in view of the differences in cost elements used in calculating the cost of the various alternatives. As noted earlier, such elements as general administration and reference service costs have been omitted from annual recurring costs, and selection and review of titles has been transferred from initial to annual costs. Overhead costs have been deleted throughout. In addition, discount and inflation rates were not generally applied in 1968. Labor costs, which comprise the major portion of all costs, have also increased substantially since 1968.

The crossover point for the decision to continue or discontinue a $20 subscription with the retention of back issues in 1968 was about six normalized annual uses; in 1977, it ranged from six to seven uses for a $40 subscription and a $3 external borrowing cost. One would conclude that the crossover points for similar cases have not changed much from 1968. Costs on both sides of the decision -- owning versus borrowing -- have apparently escalated about the same.

Impact of the "CONTU Guidelines"

The "CONTU guidelines" for photocopying periodical materials defines the securing of more than five copies per year from a title, of an article or articles published within the five previous years, as essentially substituting for subscribing to a periodical, and thus subject to authorization from the copyright proprietor, who may require royalty payment. Should a library apply cost-only considerations to their selection policies, and not subscribe to periodical titles which application of the model shows to be more economically borrowed, the necessary level of borrowing would place many of the more expensive titles in the area in which securing of over five copies is more economic than subscribing, even where the highest ($8) external borrowing costs apply. In these cases, to evaluate realistically the economy of borrowing, calculations of applicable external borrowing costs would necessarily include copyright royalty payments. In view of the substantial number of titles held in libraries that are not used at all (according to recent studies), however, it would appear unlikely that libraries would readily eliminate those with an average of more than five uses per year.

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APPENDIX A

A MODEL FOR THE PRESENT VALUE OF ALTERNATIVE LIBRARY POLICIES FOR PERIODICAL PUBLICATIONS

APPENDIX A

A MODEL FOR THE PRESENT VALUE OF ALTERNATIVE LIBRARY POLICIES FOR PERIODICAL PUBLICATIONS

The cost over the planning period associated with a periodical title can be expressed as follows:

$$C = \sum_{y=1}^{P} \frac{C_y}{(1+r)^{y-1}} \qquad (A-1)$$

where C is the present value of costs, P denotes the planning period, y denotes a year in the planning period (i.e., y = 1, 2, 3, ..., P), C_y denotes the cost incurred in year y, and r denotes the nominal or monetary discount rate. This appendix develops an explicit expression for C.

The cost incurred in year y of the planning period, C_y, is given by:

$$C_y = I_y + P_y + M_y + S_y + W_y + U_y + B_y \qquad (A-2)$$

where the quantities on the right are defined in Table A-1.

TABLE A-1

COMPONENTS OF ANNUAL COST

Symbol in equation A-2	Cost Component
I_y	Initial cost of acquiring and cataloging a new title, zero except for y=1
P_y	Subscription cost in year y
M_y	Recurring annual costs such as check in, claiming, binding, marking, etc. in year y
S_y	Storage cost in year y
W_y	Disposal or weeding cost in year y
U_y	Cost of using in year y volumes of title held at library
B_y	Cost of borrowing from external sources in year y volumes not held by the library

The alternative policies for a periodical title affect the cost components in different ways, depending on which volumes of the title are held by the library. The first three cost components I_y, P_y and M_y are independent of the total number of volumes of a title held by the library. The storage cost, S_y, is porportional to the number of volumes of the periodical title held by the library in year y. The weeding cost is proportional to the number of volumes of the periodical discarded in year y.

The costs of using volumes held by the library in year y depends on which volumes are held by the library; and the cost of borrowing volumes not held by the library in year y depends on which volumes must be obtained from outside sources. These conditions are expressed by the following equations:

$$S_y = C_{vy}\alpha_y \qquad \text{(A-3)}$$

$$W_y = C_{wy}w_y \qquad \text{(A-4)}$$

$$U_y = C_{uy}D_y^+ \qquad \text{(A-5)}$$

$$B_y = C_{by}D_y^- \qquad \text{(A-6)}$$

where: C_{vy} = the cost of storing an annual volume* in year y

α_y = the number of annual volumes* held by the library in year y

C_{wy} = the cost of weeding an annual volumes in year y

w_y = the number of annual volumes weeded in year y

C_{uy} = the cost of satisfying a request for an annual volume held by the library in year y

D_y^+ = the number of satisfied requests (demand) for annual volumes held by the library in year y

C_{by} = the cost of satisfying a request for an annual volume not held by the library in year y

D_y^- = the number of satisfied requests (demand) for annual volumes not held by the library in year y.

*An annual volume is defined as all the articles contained in the periodical title in one year; it is not generally equal to a bound volume though it may be.

Assuming that costs will increase at a steady rate of inflation i during the planning period gives the following equation:

$$\text{Cost in year } y = (1+i)^{y-1} \times \text{cost in year 1}. \qquad \text{(A-7)}$$

Substitution of Equations (A-2) to (A-7) in to Equation (A-1) gives:

$$C = I_1 + (M_1+P_1) \sum_{y=1}^{P} \theta^{y-1} + C_{v1} \sum_{y=1}^{P} \alpha_y \theta^{y-1} \qquad \text{(A-8)}$$

$$+ C_{w1} \sum_{y=1}^{P} w_y \theta^{y-1} + C_{u1} \sum_{y=1}^{P} D_y^+ \theta^{y-1} + C_{b1} \sum_{y=1}^{P} D_y^- \theta^{y-1}$$

where

$$\theta = \frac{1+i}{1+r} \cdot \qquad \text{(A-9)}$$

A computer program written in APL was used to calculate the cost C according to Equations (A-8) and (A-9). A listing of this program appears in Table A-2.

The quantities α_y and w_y, appearing in Equation (A-8), depend on the following parameters:

- the age of oldest volume of the periodical title held by the library in year y=1
- The age of the first volume of the periodical title in year y=1
- the cutoff age for the periodical title, the age at which annual volumes of a title are first weeded from the collection; i.e., annual volumes whose age equals or exceeds the cutoff age are weeded from the collection.

The quantities D_y^+ and D_y^- appearing in Equation (A-8) depend on the above quantities and the following as well:

- the normalized annual demand for the periodical title; i.e., the annual demand for a title with 10 years of back issues
- the decay of demand for a periodical title with age.

Equations relating α_y, W_y, D_y^+ and D_y^- to the above quantities are derived below and are embedded in the APL listing in Table A-2.

α_y

The number of annual volumes of the periodical title held by library in year y is:

$$\alpha_y = \alpha_y^+ - (\alpha_y^- - 1) \qquad \text{(A-10)}$$

where

α_y = the number of annual volumes held by the library in year y

α_y^+ = age of the oldest annual volume of the periodical title held by the library in year y

α_y^- = age of the youngest annual volume of the periodical title held by the library in year y.

We now derive expressions for α_y^+ and α_y^-.

First consider the case where the cutoff age is sufficiently large that no weeding takes place over the planning period. Then:

$$\alpha_y^+ = a_1 + y - 1 \qquad \text{(A-11)}$$

where

a_1 = the age of the oldest volume of the periodical title in year 1

$$\alpha_y^- = \begin{cases} 0 & \text{if the subscription is maintained} \\ y-1 & \text{if the subscription is terminated.} \end{cases} \qquad \text{(A-12)}$$

Now consider the effect of having a cutoff age which may require some weeding. No annual volumes with ages equal to or greater than the cutoff age will be held by the library. Hence, the more general experssion for α_y^+ is:

$$\alpha_y^+ = \min(a_1 + y - 1, a_c - 1) \qquad \text{(A-13)}$$

where

a_c = the cutoff age for the periodical title; when annual volumes reach the cutoff age, they are purged from the collection.

When the subscription to a periodical title is terminated, the age of the youngest title increases with a value of y-1 as we advance into the planning period. When this age equals a_c-1, only one annual volume is held by the library. (This is in accord with Equation A-10.) We therefore define α_y^- to be equal to a_c when all annual volumes of the periodical volume have been weeded from the library. This definition ensures that Equation A-10 remains valid when all annual volumes of a periodical title have been disposed of. Therefore, the more general expression for α_y^- is:

$$\alpha_y^- = \begin{cases} 0, \text{ subscription maintained} \\ \min (y-1, a_c), \text{ subscription terminated.} \end{cases} \quad \text{(A-14)}$$

W_y

The number of volumes weeded in year y, W_y, will be 0 unless the age of the oldest volume as given by (A-11) equals or exceeds the cutoff age. For year 1 we have:

$$W_1 = \max [0, a_1 - (a_c - 1)] \quad \text{(A-15)}$$

For subsequent years, when the subscription is maintained, we have:

$$W_y = \begin{cases} 1, \text{ if } a_1+y-1 \geq a_c \\ 0, \text{ if } a_1+y-1 < a_c \end{cases} \quad \text{(A-16)}$$

When the subscription is terminated we have:

$$W_y = \begin{cases} 1, \text{ if } a_1+y-1 \geq a_c \text{ and } a_c \geq y-1 \\ 0, \text{ otherwise.} \end{cases} \quad \text{(A-17)}$$

D_y^+ and D_y^-

These quantities can be derived from the cumulative demand curve for the periodical title, D(a), which is given by:

$$D(a) = \frac{F(a)}{F(10)} D(10) \quad \text{(A-18)}$$

where

D(a) = the demand for annual volumes of a periodical title whose ages are less than or equal to a.

$D(10)$ = the normalized demand per year for a periodical title; i.e., the demand for a title with 10 years of back issues; or the demand for the most recent 10 years of a periodical title.

$F(a)$ = the fraction of total demand for annual volumes of a periodical title whose ages are less than or equal to a, where a = 0, 1, 2, 3,...

The total demand for a periodical title in year y, D_y, is estimated to be:

$$D_y = D(\alpha_y^*) \tag{A-19}$$

where

D_y = total demand for a periodical title in year y.

α_y^* = age of the first annual volume of the periodical title in year y.

The quantity α_y^* is given by:

$$\alpha_y^* = b_1 + y - 1 \tag{A-20}$$

where

b_1 = the age of the first volume of the periodical title in year 1.

The demand in year y for annual volumes of the title held by the library is:

$$D_y^+ = D(\alpha_y^+) - D(\alpha_y^- - 1) \tag{A-21}$$

The demand in year y for annual volumes not held by the library is:

$$D_y^- = D_y - D_y^+ \tag{A-22}$$

Because the current year (y=1) corresponds to an age of zero (a=0), it is convenient to define:

$$D(-1) = 0. \tag{A-23}$$

This permits us to evaluate Equation (A-21) when $\alpha_y^- = 0$, a condition that occurs whenever the subscription is maintained.

Tables A-3 through A-7 show the input and output formats used in the APL program. Table A-3 shows the inputs for Library A for the use where the subscription is maintained, and table A-4 is the corresponding output. For the case where the subscription is terminated and back issues are retained, table A-5 gives the inputs, table A-6 gives the costs outputs, and table A-7 shows the values of the parameters used in this computer run.

A copy of the APL computer program is available at cost from the Public Research Institute. The current 1977 cost of the program is $50.

TABLE A-2

LISTING OF APL PROGRAM FOR COMPUTING COST

```
    ∇ INPUT
[1]     '                    LIBRARY COST MODEL  BE'
[2]     RID←⍞'RUN IDENTIFICATION='
[3]     INT←⎕⍞'INTEREST RATE='
[4]     INF←⎕⍞'INFLATION RATE='
[5]     PLN←⎕⍞'PLANNING PERIOD IN YEARS='
[6]     GD←(1 0 1 0 2)['YN10'⍳1+⍞'DO DEMANDS DROP OF GEOMETRICALLY WITH AGE?']
[7]     →(B2,B1)[GD+1]
[8]    B1:DEC←⎕⍞'DEMAND DECAY FACTOR='
[9]     CUMS←(1-DEC*¯1+⍳(1+BEG+PLN))+(1-DEC)
[10]    →B3
[11]   B3:CST←⎕⍞'STORAGE COST='
[12]    CWE←⎕⍞'WEEDING COST='
[13]    CUS←⎕⍞'INTERNAL USE COST='
[14]    CBINT←⎕⍞'INTERNAL COST OF BORROWING='
[15]    CBEXT←⎕⍞'EXTERNAL COST OF BORROWING='
[16]    CBR←CBINT+CBEXT
[17]    AGE←⎕⍞'AGE OF OLDEST VOLUME IN THE COLLECTION ='
[18]    BEG←⎕⍞'AGE OF FIRST VOLUME OF THE TITLE='
[19]    NSW←(1 0 1 0 2)['YN10'⍳1+⍞'IS THIS A NEW SUBSCRIPTION?']
[20]    →(L8,L6)[NSW+1]
[21]   L1:SM←(1 0 1 0 2)['YN10'⍳1+⍞'IS SUBSCRIPTION MAINTAINED?']
[22]    →(L5,L7)[SM+1]
[23]   L7:M←⎕⍞'RECURRING ANNUAL COST (EXCLUDING SUBSCR COST)='
[24]    NP←⎕⍞'HOW MANY SUBSCRIPTION COSTS DO YOU WISH TO ENTER?'
[25]    J←0
[26]    P←NP⍴0
[27]   L2:J←J+1
[28]    P[J]←⎕⍞'P(',(7⌶J),')='
[29]    →(J<NP)/L2
[30]   L4:NC←⎕⍞'HOW MANY VALUES OF CUTOFF AGE DO YOU WISH TO CONSIDER?'
[31]    COA←NC⍴0
[32]    J←0
[33]   L9:J←J+1
[34]    COA[J]←⎕⍞'COA(',(7⌶J),')='
[35]    →(J<NC)/L9
[36]    ND←⎕⍞'HOW MANY ANNUAL DEMANDS DO YOU WISH TO CONSIDER?'
[37]    DT←ND⍴0
[38]    J←0
[39]   L3:J←J+1
[40]    DT[J]←⎕⍞'D(',(7⌶J),')='
[41]    →(J<ND)/L3
[42]    '⍞⍞THIS COMPLETES THE INPUT. TO COMPUTE COSTS TYPE COST AND PRESS RETURN
KEY.'
[43]    '                              TO CHECK INPUTS TYPE PARAMS AND PRESS RETURN K
EY.'
[44]    →0
[45]   B2:CUMS←⎕⍞'ENTER CUMULATIVE DEMAND SHAPE AS A VECTOR:LENGTH=PLN+BEG+1'
[46]    →B3×⍳(⍴CUMS=PLN+BEG+1)
```

TABLE A-2 (Cont'd)

```
[47]   'LENGTH OF VECTOR INCORRECT, TRY AGAIN.'
[48]   →B2
[49]  L5:M←0
[50]   NP←1
[51]   P←1⍴0
[52]   →L4
[53]  L6:SM←1
[54]   CIN←⍞'INITIAL COST='
[55]   →L7
[56]  L8:CIN←0
[57]   →L1
    ∇


    ∇ R←QQ A
[1]     M←A,' '
[2]     R←M
    ∇


    ∇ PARAMS
[1]     'RUN IDENTIFICATION,RID= ';RID
[2]     'INTEREST RATE,INT= ';INT
[3]     'INFLATION RATE,INF= ';INF
[4]     'STORAGE COST,CST= ';CST
[5]     'WEEDING COST,CWE= ';CWE
[6]     'INTERNAL USE COST,CUS= ';CUS
[7]     'INTERNAL COST OF BORROWING,CBINT=';CBINT
[8]     'EXTERNAL COST OF BORROWING,CBEXT=';CBEXT
[9]     'BORROWING COST,CBR= ';CBR
[10]    'INITIAL COST,CIN= ';CIN
[11]    'AGE OF OLDEST VOLUME IN THE COLLECTION,AGE= ';AGE
[12]    'AGE OF FIRST VOLUME OF THE TITLE,BEG= ';BEG
[13]    'SUBSCRIPTION MAINTAINED SWITCH,SM= ';SM
[14]    'NEW SUBSCRIPTION SWITCH,NSW=';NSW
[15]    'PLANNING PERIOD,PLN= ';PLN
[16]    'DEMAND DECAY FACTOR,DEC= ';DEC
[17]    'RECURRING ANNUAL COST (EXCLUDING SUBSCR. COST),M= ';M
[18]    'NUMBER OF CUTOFF AGES,NC= ';NC
[19]    'CUTOFF AGES,COA= ';COA
[20]    'NUMBER OF SUBSCRIPTION COSTS,NP= ';NP
[21]    'SUBSCRIPTION COSTS,P=';P
[22]    'NUMBER OF DEMANDS,ND= ';ND
[23]    'DEMAND VALUES,DT= ';DT
[24]    'CUMULATIVE DEMAND VS AGE SHAPE,CUMS:'
[25]    CUMS
    ∇
```

TABLE A-2 (Cont'd)

```
    ∇ COST
[1]   ⍝MASTER PROGRAM FOR COMPUTING COSTS OF OWNING AND BORROWING SERIAL TITLES
[2]   PRELIM
[3]   ANNUAL
[4]   STORE
[5]   WEED
[6]   DEMANDS
[7]   COSTIN
[8]   COSTOUT
[9]   CR←(NC,ND)⍴0
[10]  OUTPUT
    ∇

    ∇ PRELIM
[1]   CUT←COA+1
[2]   AGEV←NC⍴AGE
[3]   ⍝THETA
[4]   TH←(1+INF)*(1+INT)
[5]   T←¯1+⍳PLN
[6]   X←⍳PLN+1
[7]   THT←0,TH*T
[8]   AGET←1,AGE+T+2
[9]   BEGT←1,BEG+T+2
[10]  TE←0,T
[11]  ALFP←CUT∘.⌊AGET
[12]  ALFM←2+(COA∘.⌊TE)×SM=0
[13]  ALFT←1+ALFP-ALFM
[14]  MV←NP⍴M
[15]  NCUM←CUMS×(⍉CUMS[11])
[16]  CUMD←(,DT)∘.×NCUM
    ∇

    ∇ ANNUAL
[1]   ⍝PRESENT VALUE OF ANNUAL EXPENSES
[2]   TH←TH+0.000001×(TH=1)
[3]   DEC←DEC+0.000001×(GRO×TH×DEC=1)
[4]   A←(MV+P)×+/THT
    ∇


    ∇ STORE
[1]   ⍝PRESENT VALUE OF STORAGE COST
[2]   CV←CST×+/ALFT×(((⍴CUT)⍴1)∘.×THT)
    ∇
```

TABLE A-2 (Cont'd)

```
    ∇ WEED
[1]     ⍝WEEDING COST--
[2]     ALPW←(CUT+1)∘.LTE
[3]     WT1←CUT∘.<AGET
[4]     WT0←(CUT∘.<AGET)∧(CUT∘.≠TE)
[5]     WT←(WT0×(SM=0))+WT1×(SM=1)
[6]     W1←0⌈AGEV+1-COA
[7]     WT[;1 2]←⍉(2,NC)⍴W2←(NC⍴0),W1
[8]     CW←CWE×+/WT×(((⍴CUT)⍴1)∘.×THT)
    ∇

    ∇ DEMANDS
[1]     DIST←2 1 3⍉(ND,NC,PLN+1)⍴(CUMD[;,ALPP]-CUMD[;,ALPW-1])
[2]     DIST[;;1]←(NC,ND)⍴0
[3]     DTOT←(NC,ND,PLN+1)⍴CUMD[;,BEGT]
[4]     DTOT[;;1]←(NC,ND)⍴0
[5]     DOST←DTOT-DIST
[6]     DIS←+/DIST
[7]     DOS←+/DOST
    ∇


    ∇ COSTOUT
[1]     CB←CBR×+/DOST×((⍴DIST)⍴THT)
    ∇


    ∇ OUTPUT
[1]     '                              COST MODEL FOR SERIAL TITLES R'
[2]     DA←ND,1
[3]     →(L1,L2)[SM+1]
[4]   L1:'SUBSCRIPTION TERMINATED '
[5]     →L3
[6]   L2:'SUBSCRIPTION MAINTAINED'
[7]   L3:J←0
[8]   L4:J←J+1
[9]     K←0
[10]  L5:K←K+1
[11]    'BFOR CUTOFF AGE= ';COA[J]
[12]    'FOR SUBSCRIPTION COST= ';P[K]
[13]    'E  DEMAND    IN      AM       STO    RES   NEED  USE    ROR    TOT      DOS
   DIS     '
[14]    C←(DA⍴CIN),(DA⍴A[K]),(DA⍴CV[J]),(DA⍴(-CR[J;])),(DA⍴CW[J]),(DA⍴CU[J;]),DA⍴
CB[J;]
[15]    CT←+/C
[16]    B←C,CT
[17]    E←(DA⍴DOS[J;]),(DA⍴DIS[J;])
[18]    ((DA⍴DT+0.05)⍕7 4 2 0),' ',((B+0.5)⍕7 5 1 0),' ',((E+0.5)⍕6 4 1 0)
[19]    →(K<NP)/L5
[20]    →(J<NC)/L4
[21]    →L6×⍳CSW=0
[22]    'EE OPTIMUM CUTOFF AGE NOT COMPUTED IN THIS VERSION OF PROGRAM'
[23]  L6:'EEEND OF RUN  ',RID
    ∇
```

TABLE A-3

```
INPUT
                LIBRARY COST MODEL

RUN IDENTIFICATION= EXAMPLE OF INPUT AND OUTPUT
INTEREST RATE= .06
INFLATION RATE= .04
PLANNING PERIOD IN YEARS= 25
DO DEMANDS DROP OF GEOMETRICALLY WITH AGE? NO
ENTER CUMULATIVE DEMAND SHAPE AS A VECTOR:LENGTH=PLN+BEG+1 CSND
?STORAGE COST= 0
WEEDING COST= 0
INTERNAL USE COST= .36
INTERNAL COST OF BORROWING= 7.02
EXTERNAL COST OF BORROWING= 3.00
AGE OF OLDEST VOLUME IN THE COLLECTION = 10
AGE OF FIRST VOLUME OF THE TITLE= 10
IS THIS A NEW SUBSCRIPTION? NO
IS SUBSCRIPTION MAINTAINED? YES
RECURRING ANNUAL COST (EXCLUDING SUBSCR COST)= 24.45
HOW MANY SUBSCRIPTION COSTS DO YOU WISH TO ENTER? 5
P(1)= 0
P(2)= 20
P(3)= 40
P(4)= 80
P(5)= 120
HOW MANY VALUES OF CUTOFF AGE DO YOU WISH TO CONSIDER? 1
COA(1)= 100
HOW MANY ANNUAL DEMANDS DO YOU WISH TO CONSIDER? 6
D(1)= .001
D(2)= 4
D(3)= 8
D(4)= 12
D(5)= 16
D(6)= 20


THIS COMPLETES THE INPUT. TO COMPUTE COSTS TYPE COST AND PRESS RETURN KEY.
                          TO CHECK INPUTS TYPE PARAMS AND PRESS RETURN KEY.
```

TABLE A-4

COST

COST MODEL FOR SERIAL TITLES

SUBSCRIPTION MAINTAINED

FOR CUTOFF AGE= 100
FOR SUBSCRIPTION COST= 0

DEMAND	IN	AN	STO	RES	WEED	USE	BOR	TOT	DOS	DIS
0.0	0.	491.	0.	0.	0.	0.	0.	491.	0.	0.
4.0	0.	491.	0.	0.	0.	31.	0.	522.	0.	108.
8.0	0.	491.	0.	0.	0.	62.	0.	553.	0.	216.
12.0	0.	491.	0.	0.	0.	93.	0.	584.	0.	323.
16.0	0.	491.	0.	0.	0.	124.	0.	615.	0.	431.
20.0	0.	491.	0.	0.	0.	155.	0.	646.	0.	539.

FOR CUTOFF AGE= 100
FOR SUBSCRIPTION COST= 20

DEMAND	IN	AN	STO	RES	WEED	USE	BOR	TOT	DOS	DIS
0.0	0.	893.	0.	0.	0.	0.	0.	893.	0.	0.
4.0	0.	893.	0.	0.	0.	31.	0.	924.	0.	108.
8.0	0.	893.	0.	0.	0.	62.	0.	955.	0.	216.
12.0	0.	893.	0.	0.	0.	93.	0.	986.	0.	323.
16.0	0.	893.	0.	0.	0.	124.	0.	1017.	0.	431.
20.0	0.	893.	0.	0.	0.	155.	0.	1048.	0.	539.

FOR CUTOFF AGE= 100
FOR SUBSCRIPTION COST= 40

DEMAND	IN	AN	STO	RES	WEED	USE	BOR	TOT	DOS	DIS
0.0	0.	1294.	0.	0.	0.	0.	0.	1294.	0.	0.
4.0	0.	1294.	0.	0.	0.	31.	0.	1325.	0.	108.
8.0	0.	1294.	0.	0.	0.	62.	0.	1356.	0.	216.
12.0	0.	1294.	0.	0.	0.	93.	0.	1387.	0.	323.
16.0	0.	1294.	0.	0.	0.	124.	0.	1418.	0.	431.
20.0	0.	1294.	0.	0.	0.	155.	0.	1449.	0.	539.

FOR CUTOFF AGE= 100
FOR SUBSCRIPTION COST= 80

DEMAND	IN	AN	STO	RES	WEED	USE	BOR	TOT	DOS	DIS
0.0	0.	2097.	0.	0.	0.	0.	0.	2097.	0.	0.
4.0	0.	2097.	0.	0.	0.	31.	0.	2128.	0.	108.
8.0	0.	2097.	0.	0.	0.	62.	0.	2159.	0.	216.
12.0	0.	2097.	0.	0.	0.	93.	0.	2191.	0.	323.
16.0	0.	2097.	0.	0.	0.	124.	0.	2222.	0.	431.
20.0	0.	2097.	0.	0.	0.	155.	0.	2253.	0.	539.

FOR CUTOFF AGE= 100
FOR SUBSCRIPTION COST= 120

DEMAND	IN	AN	STO	RES	WEED	USE	BOR	TOT	DOS	DIS
0.0	0.	2901.	0.	0.	0.	0.	0.	2901.	0.	0.
4.0	0.	2901.	0.	0.	0.	31.	0.	2932.	0.	108.
8.0	0.	2901.	0.	0.	0.	62.	0.	2963.	0.	216.
12.0	0.	2901.	0.	0.	0.	93.	0.	2994.	0.	323.
16.0	0.	2901.	0.	0.	0.	124.	0.	3025.	0.	431.
20.0	0.	2901.	0.	0.	0.	155.	0.	3056.	0.	539.

END OF RUN EXAMPLE OF INPUT AND OUTPUT

TABLE A-5

```
INPUT
                LIBRARY COST MODEL

RUN IDENTIFICATION= EXAMPLE OF TERMINATING A SUBSCRIPTION
INTEREST RATE= .06
INFLATION RATE= .04
PLANNING PERIOD IN YEARS= 25
DO DEMANDS DROP OF GEOMETRICALLY WITH AGE? NO
ENTER CUMULATIVE DEMAND SHAPE AS A VECTOR:LENGTH=PLN+BEG+1 CSND
STORAGE COST= 0
MENDING COST= 0
INTERNAL USE COST= .36
INTERNAL COST OF BORROWING= 7.02
EXTERNAL COST OF BORROWING= 3.00
AGE OF OLDEST VOLUME IN THE COLLECTION = 10
AGE OF FIRST VOLUME OF THE TITLE= 10
IS THIS A NEW SUBSCRIPTION? NO
IS SUBSCRIPTION MAINTAINED? NO
HOW MANY VALUES OF CUTOFF AGE DO YOU WISH TO CONSIDER? 1
COA(1)= 100
HOW MANY ANNUAL DEMANDS DO YOU WISH TO CONSIDER? 7
D(1)= .001
D(2)= 4
D(3)= 8
D(4)= 10
D(5)= 12
D(6)= 16
D(7)= 20

THIS COMPLETES THE INPUT. TO COMPUTE COSTS TYPE COST AND PRESS RETURN KEY.
                          TO CHECK INPUTS TYPE PARAMS AND PRESS RETURN KEY.
```

TABLE A-6

COST

COST MODEL FOR SERIAL TITLES

SUBSCRIPTION TERMINATED

FOR CUTOFF AGE= 100
FOR SUBSCRIPTION COST= 0

DEMAND	IN	AN	STO	RES	WEED	USE	BOR	TOT	DOS	DIS
0.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4.0	0.	0.	0.	0.	0.	5.	728.	733.	93.	15.
8.0	0.	0.	0.	0.	0.	10.	1456.	1466.	186.	30.
10.0	0.	0.	0.	0.	0.	12.	1821.	1833.	233.	37.
12.0	0.	0.	0.	0.	0.	15.	2185.	2199.	279.	44.
16.0	0.	0.	0.	0.	0.	20.	2913.	2932.	372.	59.
20.0	0.	0.	0.	0.	0.	25.	3641.	3666.	465.	74.

END OF RUN EXAMPLE OF TERMINATING A SUBSCRIPTION

TABLE A-7

```
      PARAMS
RUN IDENTIFICATION,RID= EXAMPLE OF TERMINATING A SUBSCRIPTION
INTEREST RATE,INT=  0.06
INFLATION RATE,INF=  0.04
STORAGE COST,CST=  0
WEEDING COST,CWE=  0
INTERNAL USE COST,CUS=  0.36
INTERNAL COST OF BORROWING,CBINT= 7.02
EXTERNAL COST OF BORROWING,CBEXT= 3
BORROWING COST,CBR=  10.02
INITIAL COST,CIN=  0
AGE OF OLDEST VOLUME IN THE COLLECTION,AGE=  10
AGE OF FIRST VOLUME OF THE TITLE,BEG=  10
SUBSCRIPTION MAINTAINED SWITCH,SM=  0
NEW SUBSCRIPTION SWITCH,NSW= 0
PLANNING PERIOD,PLN=  25
DEMAND DECAY FACTOR,DEC=  0.93
RECURRING ANNUAL COST (EXCLUDING SUBSCR. COST),M=  0
NUMBER OF CUTTOFF AGES,NC=  1
CUTTOFF AGES,COA=  100
NUMBER OF SUBSCRIPTION COSTS,NP=  1
SUBSCRIPTION COSTS,P= 0
NUMBER OF DEMANDS,ND=  7
DEMAND VALUES,DT=  0.001 4 8 10 12 16 20
CUMULATIVE DEMAND VS AGE SHAPE,CUMS:
 0 42.7 56 65.4 73.1 79.3 81.9 83.8 85.6 86.9 88.1 89.2 90.2 91.1 91.9 92.6 93.2
      93.7 94.1 94.4 94.6 94.9 95.2 95.5 95.8 96.1 96.3 96.5 96.7 96.9 97.1 97.3
      97.5 97.7 97.9 98.1 98.3 98.5 98.6
```

APPENDIX B

COST ELEMENTS FOR UTILIZING THE DECISION MODEL

APPENDIX B

COST ELEMENTS FOR UTILIZING THE DECISION MODEL

LIBRARY COST FACTORS

Cost factors utilized in the decision model do not reflect total library costs for providing periodical (defined here as journal) services. General administration and supervision costs have been excluded, since such costs do not appear to have any direct relationship to the number of titles held. Reference service costs have similarly been excluded, since service is not limited to in-library journal collections alone, nor do reference costs necessarily vary with the number of titles held in-house.[1]

Use of data bases, which furnish bibliographic data and abstracts of journal articles, are an expanding phenomenon in research libraries and provide an increasingly common periodical service cost, although charges for them varies from full cost recovery from patron to full cost borne by the library. In some aspects, these data bases may be viewed as duplicate subscriptions (in another form) to reference journals also held in print. While in this study, data base costs have been considered reference rather than materials costs and excluded from the cost data, it may be pertinent at a future date to compare cost and use data for printed reference periodicals versus data base search, in reviewing continuance of increasingly costly reference journal subscriptions.

Library cost inputs comprised four of the cost categories used in the model. These are:

1. The average initial cost of acquiring and cataloging a new title.
2. The average annual per title cost for maintaining and servicing journal materials.
3. The average cost per use of journal materials, including circulation, interlibrary lending, and in-house use.
4. The average cost for borrowing a journal item through interlibrary loan.

---

[1] For a discussion of relevant costs to be considered when comparing alternatives, see G.H. Fisher, Cost Considerations in Systems Analysis, New York: American Elsevier Pub. Co., 1971, Chapter 3, "Concepts of Economic Costs."

In order to calculate the crossover or breakeven points in specific cost and use situations, these cost data were collected from five libraries. (The format for collection is shown in appendix C.) They are:

Library A: The main library of a large university. The 1,000,000 volumes and almost 7,000 current journal subscriptions are primarily in the humanities, social sciences, and life sciences. Almost one-quarter of total bookstock is bound journals.

Library A-1: The Engineering branch of Library A. Half of its approximately 130,000 volumes are bound periodicals, and the library has 1,425 current journal titles. The collection includes engineering fields and mathematics.

Library A-2: The Architecture branch of Library A. This small library holds 18,000 bound volumes (about one-fifth periodicals) and 145 current journal titles.

Library B: A smaller academic main library, with about 350,000 volumes, including 46,000 bound periodical volumes, and 2,615 current journal titles. The collection is similar to that of Library A, with holdings in humanities, social sciences, and life sciences. A small percentage of basic physical science materials are also included.

Library C: A large special library (science and technology) with holdings in physics, chemistry, mathematics, and technology. About four-fifths of the 125,000 volume collection is bound journals; the library carries slightly under 2,200 current journal titles, including a substantial level of gifts and exchanges.

Category I: Initial Costs for New Titles

Initial costs include labor for acquiring and cataloging new journal titles, as well as non-labor costs of providing catalog cards. Average acquisitions costs per new title have been calculated for both paid subscriptions and for subscriptions derived through gifts and exchanges. They do not include the actual subscription cost, nor, in the case of exchanges, the cost of the material exchanged.

For new paid subscriptions, acquisitions costs include:

1. Searching
2. Ordering
3. Preparation of invoices
4. Payment procedures.

Staff time spent in arranging gifts and exchanges accounts for acquisitions costs for materials received in that manner.

Selection of materials is not included among acquisition tasks in this one-time cost, since the total selection and title review process is considered to encompass review of all currently held titles in the collection. In addition, such staff time is a recurring cost which is not necessarily modified by the number of new titles added to the collection.

Cataloging costs apply to paid and free subscriptions alike, and include both cataloging and preparation of catalog cards. Where a shared cataloging system is used, costs for the bibliographic data base utilized as well as the cost of catalog cards would be included here.

Initial costs for the five sample libraries are shown in table B-1.

Category II: Annual Recurring Costs

Annual recurring costs are those labor and non-labor costs which result from routine maintenance and servicing of a periodical title. Labor tasks include:

1. Selection and review.
2. Renewal of subscriptions and preparation of invoices.
3. Ordering of missing, lost, or vandalized back issues.
4. Check-in and claiming of issues.
5. Shelving of new materials.
6. Catalog/shelf list/Kardex maintenance
7. Preparation of serials list.
8. Binding preparation, shipment and receipt, and marking.
9. Training.
10. Direct supervision (administration).

Non-labor costs include computer preparation and publication of serials list, and binding of journal volumes.

Table B-2 lists the annual recurring costs, by task, for the five libraries.

Category III: Internal Use Costs

Internal use of journals includes "circulation" of bound volumes and unbound issues, in-library use, or photocopying for use, and loaning of journal materials, or provision of photocopies of journal articles, in interlibrary loan. Unlike initial and maintenance costs which are based on the per title unit, internal use costs are based on total use of all journal items.

TABLE B-1

INITIAL COSTS FOR FIVE SAMPLE LIBRARIES

Library	Initial costs per title (dollars)[a]				
	A	A-1	A-2	B	C
New paid subscription					
Acquisitions (includes searching, orders, payments, and specific training and administration)	38.65[b]	38.65[b]	38.65[b]	7.17	29.42
Cataloging (includes cataloging and preparation of catalog cards)	32.00[c]	33.57[c]	33.57[c]	4.37	24.10
Total cost, paid subscription	70.65	72.22	72.22	11.54	53.52
New free subscription				None	
Acquisitions	12.61	12.61	12.61		13.81
Cataloging	32.00	33.57	33.57		24.10
Total cost, free subscription	44.61	46.18	46.18		37.91

[a] Labor costs include fringe benefits.

[b] All acquisitions are carried on in a single university serials department.

[c] Cataloging is done in the university serials department; branch libraries require an additional set of catalog cards.

TABLE B-2

ANNUAL RECURRING COSTS FOR FIVE SAMPLE LIBRARIES

Library	Cost per title (dollars)				
	A	A-1	A-2	B	C
Task					
Selection and review	1.95	0.15	1.76	0.66	0.85
Renewal and renewal payments (includes back issue orders)	2.74[a]	2.74[a]	2.74[a]	0.32	1.45
Check-in (includes catalog maintenance and shelving of new materials)	5.58	3.85	6.04	1.25	3.27
Claiming	0.16	0.76	0.86	0.08	0.89
Administration	0.94	3.77	1.71	Neg.	2.70
Serials list preparation	0.45[a]	0.45[a]	0.45[a]	0.56	2.43
Binding preparation	4.07	5.32	2.75	2.54	3.49
Other[b]	0.15	0.90	1.15	—	0.10
Total labor costs[c]					
Non-labor costs					
Serials list production	1.22[a]	1.22[a]	1.22[a]	d	0.63
Bindery (per annual volume)	7.17	9.14	7.42	3.90	10.13
Kardex cards	0.02	0.02	0.02	Neg.	Neg.
Total annual recurring cost per title	24.45	28.32	26.12	9.31	25.94

[a] Task performed by university serials department.

[b] Includes training, and transfer of materials.

[c] Includes fringe benefits

[d] Not charged to library.

Use patterns for journal materials in libraries vary substantially, ranging from the no circulation (outside the library) policy of many academic libraries, to the full circulation and free photocopying of the special library in our sample. Even where materials circulate, however, a substantial proportion of journal use takes place within the library. Where there is open access to materials, the measurement of internal use is difficult, and little data regarding the total volume of use of journal materials in libraries is available.

For the most part, use data in this category have been based on the reshelving of materials, both bound volumes and current issues. In libraries where observations have been made, approximately half of bound materials reshelved (including circulated monographs, etc) would appear to be journal volumes, and this has applied across most subject areas. The proportions of use of current issues to bound volumes (retrospective issues), however, varies widely by subject area.

Measuring use of journal materials by the counting of reshelved materials introduces the possibility of underestimating use because of materials reshelved by users. Among bound volumes, this may be insignificant, since user reshelving is considered to reflect a high proportion of rejection rather than use. Some underestimation of the use of current issues may result, however, since browsers of current materials frequently peruse them in adjacent seating and are more likely to return used materials to the open shelf.

Costs for internal use include:

1. Appropriate service desk "circulation" costs. This includes normal circulation costs where materials circulate, plus the labor costs of making materials available to users by locating them, directing users to them, etc. Reference costs are NOT included.
2. Photocopy costs if free photocopy service is provided to users.
3. Labor costs for reshelving of bound volumes and current issues.
4. The cost of lending periodical materials in interlibrary loan. This includes labor costs and photocopy and postage charges when these are not covered.

Unit costs per use of a periodical item is calculated by dividing total annual use costs of the four categories listed above, by the total number of items used (or reshelved, where use figures are not available). Total annual costs, annual units of use for the same period, and the resultant unit cost of internal use are shown in table B-3 for the five libraries.

TABLE B-3

INTERNAL USE COSTS FOR FIVE SAMPLE LIBRARIES

	Library				
	A	A-1	A-2	B	C
A. Total annual costs					
Circulation	$ 45,509	$ 3,223		$11,912	
Reshelving materials	10,608	2,288	$2,722	3,372	$21,285
In-library photocopying	a	a	a	a	11,137
Interlibrary lending	10,114	4,359	b	6,702	4,430
Total annual cost	$ 66,231	$ 9,870	$2,722	$21,986	$36,852
B. Total annual use					
Circulation	—	4,712[c]	—	—	5,109
Other items reshelved	183,165	28,559	4,185	37,488	71,469
Total items used	183,165	33,271	4,185	37,488	76,578
C. Unit cost of internal use	$ 0.36	$ 0.30	$ 0.65	$ 0.58	$ 0.48

[a]Patron pays for in-library photocopying.

[b]ILL is handled by main library.

[c]Materials are circulated only overnight.

Category IV. Cost of Borrowing Journal Materials Through Interlibrary Loan

Two components make up the total cost of borrowing journal materials through interlibrary loan. These are:

1. Internal borrowing costs.
2. External borrowing costs, or charges made by lending libraries.

Internal labor costs for verifying bibliographic data, locating materials, and preparing and forwarding requests have been calculated and unit costs developed on the basis of requests filled.

Many libraries are part of networks providing substantial levels of their interlibrary borrowing requirements with little or no lending library charge. Even where such arrangements do not exist, the number of libraries charging more than small amounts for processing and photocopying remains few, and average external borrowing charges reported by the sample libraries were minimal. External borrowing charges used as input for the model are not based on data collected in the libraries.

Table B-4 shows internal borrowing costs for the three sample libraries.

TABLE B-4

AVERAGE INTERNAL BORROWING COSTS FOR THREE SAMPLE LIBRARIES

Library	Average internal borrowing cost per item (dollars)
A	7.02
B	5.09
C	9.48

COST DATA FROM OTHER SOURCES

Other cost elements required for the model have been applied uniformly to all of the sample libraries. The remaining cost inputs used in the model are:

1. External borrowing costs
2. Storage costs
3. Disposition (weeding) costs
4. Subscription costs.

External Borrowing Costs

Although actual average external borrowing (or lending library) charges reported by the sample libraries are minimal, the increasing tendency to attempt to recover costs for such operations makes it necessary to illustrate the differences in crossover points if a library is required to fund the total costs of an interlibrary borrowing transaction. For this reason, external borrowing charges of $3 and $8, as well as the no charge situation, have been introduced in all decision situations.

Storage Costs

Few data are available concerning library storage costs, and most are not recent. Several problems arise in the use of this cost factor:

1. If space in existing buildings is not saturated, there is essentially no marginal storage cost; that is, there is no variation in overall cost which relates to the addition or subtraction of materials stored.

2. The costs of storage space vary greatly with the age of the buildings and equipment.

3. Replacement costs also vary with the availability of land already owned, local building costs, etc., and in addition, do not properly reflect costs of existing storage. Furthermore, replacement reflects an incremental rather than linear cost.

For use in the decision model, the assumption was made that when present storage areas are adequate sometime into the future, all materials are retained. In this case, the storage cost is "$0", since no additional costs accrue as the result of the addition. In cases where space is becoming critical, storage costs are calculated at $0.50 per annual volume.[1]

[1] A 1969 study (J.A. Raffel and R. Shishko, Systematic Analysis of University Libraries: An Application of Cost-Benefit Analysis to the M.I.T. Libraries, Cambridge, Mass.: The M.I.T. Press, 1969) provides a storage cost for open access, conventional storage on campus, with moderate use, of $0.2825 per volume equivalent (2/3 annual volume). When inflated to 1977 dollars, this equals $0.46 per volume equivalent, or $0.70 per annual volume. The 1968 Westat study had shown a slightly lower storage rate, equal to $0.33 in 1977 dollars. The midrange of these two estimates, $0.52, has been rounded to $0.50 for use here.

Disposal (Weeding) Costs

Published disposal or weeding costs have generally reflected the cost of moving materials from conventional to compact or off-site storage. Alternate kinds of storage were not addressed; here weeding represents complete loss of access to the materials removed. Several methods of weeding were analyzed and costed in Raffel and Shishko in 1969, including:

1. By publication date. Costs have been estimated at $0.20 and $0.40 per volume equivalent. This translates in 1977 dollars to $0.49 and $0.99 per annual volume, with a mean of $0.74.

2. By circulation criterion. The cost cited was $0.61, but a range of $0.80 to $1.00 per volume equivalent was considered more reasonable. In 1977 dollars this would be $1.50, or $1.97 to $2.46 per annual volume.

The primary cost difference between the two methods was the handling of individual materials to determine use, and the individual notation of catalog cards to indicate withdrawals. It is assumed that libraries would choose methods and means for minimizing weeding costs and that the average cost of the publication date method would be the more relevant. Inflated 1968 Westat weeding costs equaled $0.60. The mean of these two estimates was rounded to $0.65 per annual volume.

Subscription Costs

Clasquin, in Library Journal,[1] reported an average journal price for academic libraries in 1976 of about $40. For special libraries the average subscription price may be considerably higher. Subscription rates ranging from $0 to over $3,000 per year were reported by the sample libraries, with over 300 (almost 15 percent) of the subscriptions reported by the special library exceeding $120 in cost.

Five subscription rates, ranging from $0 to $120, were chosen to demonstrate the levels of average annual use below which borrowing is less costly than owning a title. Obviously, as subscription prices rise above $120 per year, the necessary level of use for cost economy also continues to increase.

[1] Clasquin, F.F., "Periodicals Prices: 74-76 Update," Library Journal, Oct. 1, 1976, p 2017.

APPENDIX C

METHODOLOGY FOR COLLECTION OF LIBRARY COST DATA

APPENDIX C

METHODOLOGY FOR COLLECTION OF LIBRARY COST DATA

Library costs required for the owning vs. borrowing decision model are input in four cost categories as discussed in Appendix B. They are:

Category I. Initial Costs for New Titles

- A. Acquisition of a new paid journal title
- B. Acquisition of a new free journal title
- C. Cataloging of a new title (free or paid)

Category II. Annual Recurring Costs

- A. Costs involving maintenance and servicing of all current titles
  1. Selection and review of title
  2. Renewals of current subscriptions, including preparation of invoices and renewal payments
  3. Back issue orders
  4. Check-in of materials
  5. Check-in problems
  6. Claiming
  7. Catalog/Kardex additions, maintenance, and changes
  8. Shelving new materials
  9. Supervision (only of specific tasks)
  10. Training (for above tasks)
- B. Binding Costs
- C. Serials list costs

Category III. Internal Use Costs

- A. Units of Use
- B. Total Costs of Use
  1. "Circulation"
  2. Interlibrary lending
  3. Reshelving of materials

Category IV. Internal Borrowing Costs

INSTRUCTIONS

Most of the costs required are labor costs. Current salaries and fringe benefits should be used. The Personnel Office should be able to provide a schedule of total labor costs per employee (including fringe benefits) or a schedule of annual salaries plus the percentage to be applied for fringe benefits (Social Security and/or other retirement benefits, employer paid insurance benefits, etc.). Determine the hourly rate of pay for each employee involved in periodical service activities, by dividing annual salary plus fringe benefits by 52 (weeks of the year) and then by the number of hours in that person's

normal work week. (Example: An employee works 35 hours per week for an annual salary of $9,825 plus 15 percent fringe benefits: $9,825 x 1.15 = $11,298.75/52 = $217.28/35 = $6.21 per hour. Time for hourly wage employees performing the same task at the same rate may be aggregated, with fringe benefits, if any, applied to an hourly rate.)

In general, data on the number of items processed in each task should be based on the latest data available for a full year. While the time spent on tasks will generally, of necessity, be based on current operations, if there is a substantial difference in operational procedures or quantities of materials processed between the time when numerical data are calculated and the current period when task times are collected, labor time should be adjusted to reflect an appropriate level of activity per item.

An example of the method for calculating costs of labor for the various tasks is shown below. Hours and pay rates are entered for each employee engaged in the specific task.

Acquisition of new titles (228 new paid titles)

Tasks	Hours per week	Hourly pay	Cost per week	Cost per year	Unit Cost
Searching	3.7	$3.40	$12.58	$ 654.16	$ 2.86
Preparation of orders, invoices payments	14.5	6.72	97.44	5,066.88	
	3.8	3.90	14.82	770.64	
	0.6	4.75	2.85	148.20	
	1.3	4.10	5.33	277.16	
				$6,262.88	$27.46

Note: When an individual intermingles tasks which fall into two cost categories (examples: preparation of new title and renewal invoices, shelving of new materials and re-shelving of used materials, catalog filing and maintenance, supervision of acquisitions of new and renewal materials, etc.) time may be apportioned in proportion to the number of titles or items which fall into each of the cost categories. For example: An employee spends 26 hours per week on the preparation of invoices for new and renewal titles. The library has 1000 current paid subscriptions of which 50 are new titles in the survey year (5 percent). The amount of time apportioned to new titles (Initial Cost Category) is 5 percent of 26 hours or 1.3 hours, and the 24.7 hours are then allocated to costs of renewal (Category II. Annual Recurring Costs). Where the same employee or employees are engaged in all or most of the operations of a particular cost subdivision (multiple tasks) tasks may be merged (for example, total acquisitions labor costs for new paid titles may be treated as one aggregated task rather than separating time into the specific tasks of searching, ordering, etc.).

Unit costs can be calculated for each specific task or for aggregated tasks by adding total annual costs and dividing by the appropriate number of titles. Task unit costs are then combined to provide the unit (per title) cost for the category.

CATEGORY I. INITIAL COSTS (NEW TITLES ONLY)

A. Acquisition of New Paid Journal Subscriptions

Number of new paid titles acquired (last full year data)_____

Task	Hours per week	Hourly pay	Cost per week	Cost per year
		(Complete for each employee involved)		
Preparation of orders, invoices, payments				
Other (list, if any)				

$\frac{\$}{\quad}$ ÷ number of titles = $\frac{\$}{\text{per title}}$ (A)

B. Acquisition of New Free (Gift and Exchange) Subscriptions

Show any time spent in arranging (procuring) new gifts or exchanges. DO NOT include the cost of the material exchanged.

Number of new free titles acquired (last full year data)_____

Task	Hours per week	Hourly pay	Cost per week	Cost per year

$\frac{\$}{\quad}$ ÷ number of titles = $\frac{\$}{\text{per title}}$ (B)

C. Cataloging of New Journal Titles

Total number of new journal titles cataloged (last full year data)_____

Task	Hours per week	Hourly pay	Cost per week	Cost per year
Cataloging				
Supervision and review				
Training				
Preparation of Catalog cards				
Filing cards				

$\frac{\$}{\quad}$ ÷ number of titles = $\frac{\$}{\text{per title}}$ (C1)

Non-Labor Costs	Unit costs
Total computer or network charges for on-line cataloging/number of titles cataloged (if applicable)	$_____
Cost per set of catalog cards	_____
Other, if any	_____
Total Non-Labor Costs per Title	_____(C2)
Total cataloging costs (labor and non-labor) per title (C1 + C2)	$_____ (C)

Total Initial Costs (per title)

	New paid title	New free title
Acquisitions	(A) $_____	(B) $_____
Cataloging	(C) $_____	(C) $_____
Total Initial Cost of Adding a New Title	$_____	$_____

CATEGORY II. ANNUAL RECURRING COSTS

A. Annual Labor Costs for Maintenance and Servicing of a Journal Title

Total number of current journal titles (current data) _____

Task	Hours per week	Hourly rate	Cost per week	Cost per year
Selection and review of titles				
Renewals, invoices, renewal payments				
Back issue orders				
Check-in				
Check-in problems				
Claiming				
Catalog/Kardex additions, maintenance, changes				
Shelving new materials				
Supervision	(only of specific tasks. EXCLUDE overall Administration)			
Training				

Total Labor Costs for Annual Maintenance $\frac{\$_____}{_____}$ ÷ number of titles = $\frac{\$_____}{_____}$ (A)

B. Binding

No. of journal titles bound (last full year data) _____

Total no. of bound journal volumes (same period) _____

Cost of binding, per bound volume _____

1. Labor costs (preparation, shipment, receipt, marking, records)

Task	Hours per week	Hourly rate	Cost per week	Cost per year

Total labor cost (binding preparation and receipt) $\frac{\$_____}{_____}$ ÷ number of titles bound = $\frac{\$_____}{\text{per title}}$ (B1)

CATEGORY II. (continued)

2. Binding costs

Total number of bound journal volumes / Number of journal titles bound = average no. of volumes per title

Average no. of volumes per title x cost of binding per volume = cost of binding an annual volume $_____ (B2)

C. Serials List

No. of journal titles in serials list _____

1. Labor costs (in-library) for serials list entries, changes, corrections

Task	Hours per week	Hourly rate	Cost per week	Cost per year

Total labor costs, serials list preparation

$_____ ÷ number of journal titles in list = $_____ per title (C1)

Number of Total Titles in Serials List _____

2. Serials list production

Total cost for	Cost per year
Keypunch	
Programming	
Supervision	
Computer time	
Total cost for serials list production	

$_____ ÷ no. of total titles in serials list = $_____ per title (C2)

D. Cost of Record Keeping Materials

Kardex or other records used (per title) $_____ (D1)

CATEGORY II. (continued)

Total Annual Recurring Costs (per title)

		Unit cost
Annual maintenance costs (labor)	(A)	_____
Labor costs, binding preparation	(B1)	_____
Cost of binding, per annual volume	(B2)	_____
Labor costs, serials list preparation	(C1)	_____
Serials list production costs	(C2)	_____
Record materials costs	(D1)	_____
Total annual recurring cost per title		$_____

CATEGORY III. INTERNAL USE COSTS

A. Units of Use

Unless the library uses another method of determining the use of journal materials, the reshelving of materials can be utilized as the measure of journal use. If use records have been maintained to include the age of materials used, record use data as follows:

Age of materials used (minimum breakdown)	Number of items used (or reshelved)	Cumulative percent of use as a function of age
< 1 (current issues)		
1-5		
6-10		
11-15		
16-25		
25+		
Total items used		

To determine the use curve for library materials, the cumulative data above should be graphed with the curve extended to show projected use through the total age of the back issues held. Cumulations of use for each year through this period can then be entered into the model to provide a specific curve for the library or particular subject collections in the library, or for comparison with use data shown in the calculations in the text.

If no age records have been maintained, determine the total number of issues reshelved, including materials:

	Number of items reshelved
Circulated	
Used in interlibrary loan	
Collected from tables, reshelving areas, etc.	
Total items used (reshelved)	

B. Internal Use Costs

1. "Circulation" of journal materials.

a. Labor costs for "circulation"

(If journals do not circulate, include here the staff time spent in making the materials available to users - locating materials, directing users to materials, etc. DO NOT include reference time.)

Hours per week	Hourly pay	Cost per week	Cost per year

Total labor cost for "circulation" $_____ (1a)

b. Non-labor costs of circulation
(Where journal materials are circulated and there is a mechanized or automated circulation systems used, enter the journal circulation proportion of total circulation system costs here.)

$_____ (1b)

2. Interlibrary loan of journal items

a. Labor costs of lending

Task	Hrs per week	Hourly pay	Cost per week	Cost per year

Total labor cost for lending $_____ (2a)

b. Non-labor costs of lending
(Where costs are not recovered by charges to the borrowing library, enter here the charges for postage and photocopying.)

	Cost per year
Postage	
Photocopying	
Other	

Total non-labor costs of lending $_____ (2b)

3. Reshelving of Materials (labor cost)

Hours per week	Hourly pay	Cost per week	Cost per year

Total cost (labor) of reshelving journal items (bound volumes and unbound issues) $_____ (3)

Total Annual Internal Use Cost

		Total cost per year
Total labor cost for "circulation"	(1a)	$_____
Total non-labor cost for circulation	(1b)	_____
Total labor cost for lending	(2a)	_____
Total non-labor cost for lending	(2b)	_____
Total cost for reshelving journal items	(3)	_____

Total annual use cost $_____ ÷ total number of items used (or reshelved) = $_____ per item used

CATEGORY IV. INTERLIBRARY BORROWING COSTS
(Internal Borrowing Cost)

Number of items borrowed (filled requests - last full year data) _____

A. Labor Costs for Borrowing

Task	Hours per week	Hourly rate	Cost per week	Cost per year

Total labor costs for borrowing $_____ ÷ total number of filled requests = $_____ (A1)

B. Non-labor Costs of Borrowing

(If costs are not reimbursed by the patron requesting the item, enter here.)

	Cost per year
Postage	
Other	

Total non-labor costs of borrowing (except lending library charges) $_____ ÷ number of filled requests = $_____ (A2)

Total Internal Borrowing Unit Costs

Labor costs for borrowing (A-1) _____

Non-labor costs for borrowing (A2) _____

Per item cost for borrowing in interlibrary loan $_____

Note: Average external borrowing costs for the library (lending library charges) may be calculated by dividing the total amount paid (last full year data) by the total number of requests filled (same period).

APPENDIX D

COLLECTION WEEDING OPTIONS

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COLLECTION WEEDING OPTIONS

Few libraries are currently planning expansion of storage space, and the weeding of journal collections is a rapidly approaching prospect for many. Several studies in the late 1960s addressed weeding in the form of movement of lesser used materials to compact storage areas. Raffel and Shishko[1] determined that this was most economically done by a movement of gross classes of materials (for example, transferring a Dewey classification collection in a library which has primarily converted to the LC classification system, etc.).

Examination of individual use records and modification of individual bibliographic records are expensive procedures (see weeding costs in appendix B), although this method would undoubtedly insure optimal user access to materials. Moving to compact storage by date of publication is considerably less costly, although this decreases accessibility to some more heavily used materials and may necessitate more expensive location and retrieval methods.

Altogether, it is concluded that even in the less expensive cases, costs of transfer and access, coupled with decreased access to materials, tend to offset the slightly lower costs of compact storage as against conventional storage and there is relatively little cost benefit from the transfer. For this reason, cost factors associated with moving materials to compact storage for retention are not considered here and weeding decisions reflect the removal and discard of materials at optimal cutoff ages.

Utilizing the appropriate subject area use curve, the total cost per title for maintenance and use, or weeding and borrowing, of materials at various cutoff ages have been calculated. Optimal weeding ages are chosen on the use curve to reflect the point at which storage and use costs begin to exceed the cost of weeding and borrowing materials.

Subscription cost was not a factor in choosing the optimal cutoff age since the subscription was to be continued in force and only weeding of back issues was in question. Costs of five different options were compared. They are:

Option 1. Retain all issues
Option 2. Weed at 20 years
Option 3. Weed at 15 years
Option 4. Weed at 10 years
Option 5. Weed at 5 years

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[1] J.A. Raffel and R. Shishko, Systematic Analysis of University Libraries: An Application of Cost-Benefit Analysis to the M.I.T. Libraries, Cambridge, Mass.: The M.I.T. Press, 1969.

All options include binding of materials. Since storage was considered critical, storage costs were also included in all options.

Table D-1 shows the cheapest of these options (using numbers above) for the three libraries, with external borrowing costs of $0, $3, and $8, at levels of use from 0.1 to 30. Lines divide the levels of use at which borrowing is cheaper (above the line) from those at which maintaining the title is cheaper (below the line). Two figures (e.g., 4/3) indicate that costs are the same for both options.

TABLE D-1

COST COMPARISONS FOR FIVE RETENTION OPTIONS
(Title with 10 years of back issues at
beginning of 25 year planning period)

Average annual use of periodicals in 11th year	Cheapest retention option[1]								
	EBC[2] = $0			EBC = $3			EBC = $8		
	Library			Library			Library		
	A	B	C	A	B	C	A	B	C
0.1	5	5	5	5	5	5	5	5	5
1	5	5	5	5	5	5	5	5	5
3	5	5	4	4	5	2	4	4	2
5	4	5	2	3	4	2	3	3	2
7	3	4	2	3	3	2	2	3	2
10	3	4/3	2	3	3	2	1	2	2
12	3	3	2	2	3	2	1	1	2
15	2	3	2	2/1	2	2	1	1	2
17	2	3	2	1	2	2	1	1	2
20	2	3	2	1	1	2	1	1	1
25	1	2	2	1	1	2	1	1	1
30	1	2	2	1	1	1	1	1	1

[1] Retention options for periodicals are defined in text.

[2] EBC = External Borrowing Cost.

Weeding at five or ten years is cheapest only for those levels of use at which borrowing is the less expensive alternative. The level of use at which cutoff ages of 15 and 20 years are cheapest decreases with the level of lending library charges.

Where low cost borrowing is available, weeding at 20 years is feasible, in terms of cost, at the 20 annual use level in Library A, and through the level of 30 average annual uses in Libraries B and C. Only relatively low levels of use permit economical weeding with high external borrowing costs, except in Library C, where the high proportion of total use of a science or technology title during the earlier ages of issues makes weeding at 20 years effective through 20 average annual uses.

Two additional weeding options were also investigated. These options considered policies of brief retention without the costs of binding preparation and bindery. They are:

Option 6. Do not bind -- weed at five years
Option 7. Do not bind -- weed at three years.

Table D-2 shows the cheapest options for the three libraries at various use levels, when these two options are added to the first five. Again the lines separate the levels of use at which borrowing or maintaining materials is the cheaper alternative.

TABLE D-2

COST COMPARISONS FOR SEVEN RETENTION OPTIONS
(Title with 10 years of back issues at
beginning of 25 year planning period)

Average annual use of periodicals in 11th year	Cheapest retention option								
	EBC = $0			EBC = $3			EBC = $8		
	Library			Library			Library		
	A	B	C	A	B	C	A	B	C
0.1	7	7	7	6	7	7	7	7	7
1	6	7	7	6	6	6	6	6	6
3	6	6	6	6	6	6	6	6	6
5	6	6	6	6	6	6	6	6	6
7	6	6	6	6	6	6	6	3	2
10	6	6	2	6	3	2	1	2	2
12	6	6	2	2	3	2	1	1	2
15	6	6	2	2/1	2	2	1	1	2
17	2	3	2	1	2	2	1	1	2
20	2	3	2	1	1	2	1	1	2
25	1	2	2	1	1	2	1	1	1
30	1	2	2	1	1	1	1	1	1

Brief retention of materials without binding is least expensive in all cases where materials are less expensively borrowed than held, as well as for some titles with use levels slightly above the breakeven level, even with the highest external borrowing cost. Beyond these use levels, however, options remain the same as in table D-1. Differences among libraries reflect the lower borrowing costs of Library B and the different use curve of Library C.

At least one additional option is available to libraries with space problems; that is, the retention of back issues on microform. The difficulty of estimating the average cost of microform subscriptions has been discussed in library literature and it has also been noted that the cost of dual subscriptions makes microform an expensive retention option. However, since one of the libraries providing cost data for this study has begun, in a limited way, the replacement of hard copy back issues with microfilm and could provide some cost data on their program, a cost comparison of this retention policy with other retention options was considered useful. Since no costs on microfiche were available, they are not included here.

Costs of microfilm averaged $24 per reel, and each reel contained an average of 3.2 annual volumes. Storage costs for microforms were estimated at slightly under five cents per reel per year. For purposes of the computations, average annual volumes were rounded to three per reel, and a figure of $0.016 per annual volume per year was used for microfilm storage. Costs were based on retention of hard copy for three years without binding, at which time it is replaced with microfilm. No borrowing costs accrue since all materials are available in-house. Table D-3 compares costs for all eight of the retention options discussed, showing the option which is cheapest at various levels of annual use.

Option 8. Weed hard copy at three years -- replace with microfilm.

The microfilm alternative is cheapest for almost all use levels at which maintaining a title is the preferred alternative. The combined savings in storage and binding costs more than compensates for the increased subscription costs, and since there are no borrowing costs, savings increase with the level of use. The relatively limited availability of micoform subscriptions, and the resistance to use of microfilm materials in some libraries, reduce the possibilities for implementing this option on a broad scale at the present time.

Better use data for titles and subject areas are needed to insure effective management of periodical collections. Use data collected at one of the universities mentioned earlier suggests that substantial portions of journal collections are used very little or not at all, and the library seeking to reduce journal expenditures may well begin with such titles. The model provides breakeven points for such decisions.

TABLE D-3

COST COMPARISONS FOR EIGHT RETENTION OPTIONS
(Title with 10 years of back issues at
beginning of 25 year planning period)

Average annual use of periodicals in 11th year	Cheapest retention option								
	EBC = $0			EBC = $3			EBC = $8		
	Library			Library			Library		
	A	B	C	A	B	C	A	B	C
0.1	7	7	7	7	7	7	7	7	7
1	6	7	7	6	6	6	6	6	6
3	6	6	6	6	6	6	6	6	6
5	6	6	6	6	6	8	8	6	8
7	6	6	8	8	6	8	8	8	8
10	8	6	8	8	8	8	8	8	8
12	8	6	8	8	8	8	8	8	8
15	8	8	8	8	8	8	8	8	8
17	8	8	8	8	8	8	8	8	8
20	8	8	8	8	8	8	8	8	8
25	8	8	8	8	8	8	8	8	8
30	8	8	8	8	8	8	8	8	8

As storage space becomes critical, the distribution of demand over the age of issues becomes the most important factor in determining the optimal cutoff age for holding back issues. Since much of the use of issues is in the early period after publication, analysis of the use of individual titles is necessary to determine the volume of demand beyond the suggested cutoff ages; even heavily used titles may have little use beyond a specific cutoff date. In broad terms, where the cost of storage exceeds the product of uses times borrowing cost, back issues should be discarded for greatest cost economy.

In general, it would appear that where acquired materials are little used, either subscriptions should be terminated or issues should remain unbound and retained only three to five years. Heavily used materials should be retained without cutoff; while for almost all economic levels of use, microfilm is the cheapest retention option, the greater convenience of use of hardcopy probably outweighs the considerations of lower cost. Decisions become more critical when focused on materials of moderate use, where close study of actual use beyond suggested cutoff ages should permit libraries to minimize both cost and space requirements.